

Biological Assessment
for Naval Air Station Whidbey Island, Seaplane Base

Final Report



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D-4002**

JP01 AE Study for SBP
Wastewater Treatment Plant,
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Acronyms

BA	Biological Assessment
BMPs	Best Management Practices
CBOD5	carbonaceous biochemical oxygen demand
CWA	Clean Water Act
DO	dissolved oxygen
DOD	Department of Defense
DPS	Distinct Population Segment
Ecology	Washington Department of Ecology
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
INRMP	Integrated Natural Resources Management Plan
mgd	million gallons per day
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MWCI	Marine Water Condition Index
NAS	Naval Air Station
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
PBDE	polybrominated diphenyl ether
PCE	primary constituent element
RBC	Rotating Biological Contactor
RPA	Reasonable Potential Analysis
TRC	total residual chlorine
TSS	total suspended solids
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WWTP	wastewater treatment plant

Executive Summary

This Biological Assessment (BA) was prepared by the U.S. Department of the Navy (Navy) in accordance with Section 7(c) of the Endangered Species Act (ESA) to review the proposed operation of the Crescent Harbor Wastewater Treatment Plant (WWTP) when the Navy resumes operation of the WWTP from the City of Oak Harbor. Prior to turnover to the Navy, the City will conduct repairs to the WWTP. The Navy will then operate the WWTP under a new National Pollutant Discharge Elimination System (NPDES) permit issued by EPA. This BA provides an evaluation of the proposed project and federal action in sufficient detail to determine if it may affect any federally listed threatened, endangered, or proposed fish, plant, or wildlife species and designated critical habitat.

The proposed project is for the Navy to operate the existing Naval Air Station Whidbey Island Seaplane Base WWTP, obtain a new NPDES permit, and continue to discharge treated wastewater in compliance with the Clean Water Act. The Navy would resume operation of the existing Seaplane Base WWTP from the City of Oak Harbor starting in the fall of 2018 and continue operations through 2023. At the time of Turnover, the WWTP would only receive wastewater from the Seaplane Base and there would be no wastewater from the City of Oak Harbor. By 2023, alternatives for the long-term treatment of wastewater from the Seaplane Base will be fully evaluated. This BA covers the operation and activities anticipated during the first permit period under Navy operation, which is expected to be from December 2018 through December 2023.

During the period from 2018 to 2023, the outfall pipe would be repaired and the treatment processes would be “right-sized” to more efficiently process the significantly reduced volume of wastewater produced by the Seaplane Base alone. The exterior footprint of the WWTP will not be altered. Construction best management practices and avoidance and minimization measures would be implemented, as described herein. Construction would be completed by 2021.

Effects on listed species associated with water quality, noise, or disturbance from in-water construction related to the outfall pipe repair would be insignificant due to the proposed construction methods (sliplining the pipe inside the existing pipe), the short duration, limited area of construction, and implementation of minimization measures including timing restrictions and monitoring. Construction within the lagoon plant fence line and not in-water, including new yard piping, mechanical and electrical upgrades, and structural repairs, is anticipated to be staggered over the next five-year period. This work is not expected to affect listed species.

Exposure to the effluent discharge would include both direct and indirect effects. Indirect effects might include the bioaccumulation of contaminants through the food chain from benthic communities. These effects would be limited to the mixing zone, and potential levels of contaminants would be low based on the nature and volume of the effluent and expected compliance with effluent limits of the NPDES permit.

For the listed species with potential to occur in the Action Area, there is very low potential for exposure to contaminants in the effluent discharge. Some of these species, including green sturgeon, eulachon, and humpback whale, occur only rarely in the Action Area and exposure would be unlikely or very limited. Adult Chinook salmon, steelhead, bull trout, yelloweye and bocaccio

rockfish, marbled murrelet, and killer whales may enter the mixing zone during migration and/or foraging, but would not be expected to spend extended amounts of time in one location. Therefore, exposure to contaminants in the effluent discharge is expected to be insignificant for adults of all listed species.

Juveniles using nearshore and shallow waters for migration and foraging could be in the mixing zone for short periods of time and could be exposed to pollutants (e.g., chlorine, ammonia, and metals) that exceed water quality standards. They could also be exposed to low levels of unregulated contaminants. There would be some potential for exposed juvenile salmonids to accumulate these pollutants. However, due to the relatively small size of the mixing zone, its distance off shore, and the depth of the mixing zone, the duration of any exposure is expected to be short and only affect a few individuals. Due to this short period of exposure and the relatively low levels of pollutants discharged, effects on juvenile Chinook salmon and rockfish are expected to be insignificant.

The proposed action will not affect the quantity of salmonids and other prey available to marbled murrelets, killer whales, or humpback whales for the reasons summarized above. Effects on the quality of prey for these higher trophic-level species would not be significant because very few salmonids would be exposed to metals, PBDEs, or other bioaccumulative contaminants in the small mixing zone and the levels of bioaccumulated contaminants in tissues would not be significant due to the absence or low levels of these contaminants expected in the effluent discharge and the short period of time the prey species would be feeding in the area. Furthermore, the Action Area represents a very small part of the foraging habitat for top predator species. It is unlikely that these species would spend a significant portion of time within the Action Area or consume a significant portion of their prey from the Action Area.

Based on the evaluation presented herein and summarized above, the proposed action “may affect” but is “not likely to adversely affect” federally listed species and designated critical habitat with the potential to occur in the action area.

Essential Fish Habitat

This BA includes an assessment of the potential effects on Essential Fish Habitat (EFH), as required under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA requires an evaluation of effects on EFH for federally managed fishery species. Based on the evaluation presented herein, potential effects on Pacific coast salmon, Pacific groundfish, and coastal pelagic EFH are limited to the water and substrate immediately around the diffuser and within the approximately 4.2 acre mixing zone. In addition, there may be adverse effects on salmonids if raw sewage, treated effluent, process fluids, or untreated stormwater runoff is accidentally released to the Crescent Harbor Salt Marsh.

Given that the area represented by the outfall mixing zone and the salt marsh habitat surround the WWTP is a small fraction of the rearing habitat for juveniles and foraging/migrating habitat for adults in the project Action Area, potential effects would have no overall effect on the Pacific coast salmon, Pacific groundfish, and coastal pelagic EFH. The determination of effect to EFH is no adverse effect.

Section 1

Introduction

The U.S. Department of the Navy (Navy) is proposing to take over operations of the existing Naval Air Station Whidbey Island Seaplane Base wastewater treatment plant (WWTP) in the fall of 2018 to treat wastewater generated solely from the Base. Under Section 7 of the Endangered Species Act (ESA), federal agencies are required to ensure that their actions do not jeopardize federally listed species or their habitats. The purpose of this Biological Assessment (BA) is to review the proposed Navy WWTP operations to be conducted under a new National Pollutant Discharge Elimination System (NPDES) permit, (proposed project and Federal action) in sufficient detail to determine if it may affect any federally listed threatened, endangered, or proposed fish, plant, or wildlife species and designated critical habitat.

This document also provides an evaluation and determination of effects on Essential Fish Habitat (EFH) in the project area for compliance with the Magnuson-Stevens Act and the 1996 Sustainable Fisheries Act. EFH is defined by the Magnuson-Stevens Act in 50 CFR 600.905-930 as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” In addition, this document describes measures to be implemented in compliance with the Marine Mammal Protection Act.

1.1 Project Background

The Seaplane Base WWTP was constructed in 1960 to treat wastewater from the Navy’s Crescent Capehart Housing Facility on the Base. The facility included primary and secondary lagoons and a chlorine detention chamber prior to discharge into a storm drainage ditch and into Crescent Harbor. In the lagoons, wastewater is treated through a combination of physical, biological, and chemical processes. Aerators are used to add oxygen to the wastewater to accomplish biological treatment. The WWTP also includes an anaerobic lagoon.

In 1971, the primary treatment plant building was decommissioned and the lagoons expanded to handle additional flow. A new outfall pipe into Crescent Harbor was also constructed at that time.

The City of Oak Harbor began operating the Navy-owned facilities at the Seaplane Base WWTP in 1987 under a lease to provide treatment to both City and Navy-generated wastewater. In 1990 and 1991, as part of the lease agreement, the City deepened and lined the lagoons, constructed new disinfection facilities, and extended the outfall pipe further out into Crescent Harbor. The City made other modifications and upgrades to the Seaplane Base WWTP in 2005, 2007, 2008, and 2010. In 2010, the City’s Rotating Biological Contactor (RBC) plant outfall in Oak Harbor failed and was abandoned (Ecology 2011). The City’s RBC WWTP does not have the capacity to process all the effluent from the City and it does not treat effluent from the Seaplane Base. Therefore, the Seaplane Base WWTP received both raw sewage and biosolids from the City and the Seaplane Base starting in 2010.

Disinfected secondary effluent from the Seaplane Base WWTP is discharged to Crescent Harbor via Outfall #002. The pipe is a total of 3,284 feet and consists of approximately 990 feet of older 18-

inch reinforced concrete pipe, 2,110 feet of 18-inch concrete cylinder pipe, and a 184-foot long diffuser section. The diffuser section consists of twenty-four 2.25-inch ports spaced alternately on 8-foot centers. The diffuser ports discharge horizontally at the center of the spring line of the diffuser, which terminates at 41 feet below mean lower low water (MLLW). The WWTP and outfall are currently regulated by the Washington State Department of Ecology (Ecology) through NPDES Permit WA-0020567 (Ecology 2011).

The City of Oak Harbor conducted inspections of Outfall #002 in 2008, 2009, and 2010. In 2008, a break in the line was repaired. The 2010 inspection identified that the leak discovered in 2008 had returned and that many of the diffuser ports were not functioning properly. There is a partial break where the pipe changes from the reinforced concrete pipe to the concrete cylinder pipe at approximately 990 feet from the shoreline at about -15 feet MLLW. Divers estimated that up to 25 percent of the total effluent flow was discharging from the line break, only 10 percent of the flow was discharging through the diffusers and more than 50 percent of the flow was discharging at the end of the pipe around the loosened end cap (Ecology 2011).

In 2013, the City notified the Navy of its intent to build a new WWTP sized for city-projected flows and loads. The Navy opted out of a cost share in the construction of the new WWTP due to insufficient time to evaluate the proposal and allocate funds. The new WWTP is currently under construction and is planned to start-up in 2018. The City expects to stop discharging to the Seaplane Base WWTP in mid to late 2018 after their testing/commissioning period is complete at the new plant. In the interim, an ongoing facility planning effort will develop recommendations for permanent repair or replacement of Outfall #002 (Ecology 2011).

When the Navy takes over operation of the Seaplane Base WWTP, it will see a significant drop in flows and loads because the City flows will no longer be routed to the WWTP. The Navy has applied for an NPDES permit from the U.S. Environmental Protection Agency (EPA) to be effective starting on the turnover date. The NPDES permit status is pending EPA's review and comment. The current draft permit conditions are attached in Appendix A.

1.2 Project Purpose

The purpose of the proposed project is to treat domestic and industrial wastewater generated on the Whidbey Island Seaplane Base in compliance with the Clean Water Act. The project is needed because starting in about December 2018, the City of Oak Harbor will no longer operate the Seaplane Base WWTP and will no longer treat wastewater generated from the Whidbey Island Seaplane Base. At this time, the Navy intends to resume operation of this Navy-owned WWTP, and to operate it under a permit to be issued by EPA.

1.3 Project Location and Setting

The proposed project is located at the Whidbey Island Seaplane Base WWTP, Island County, Washington (Figure 1-1). The WWTP is located on the southern shore of Whidbey Island in Puget Sound. The WWTP discharges to Crescent Harbor via existing Outfall #002.

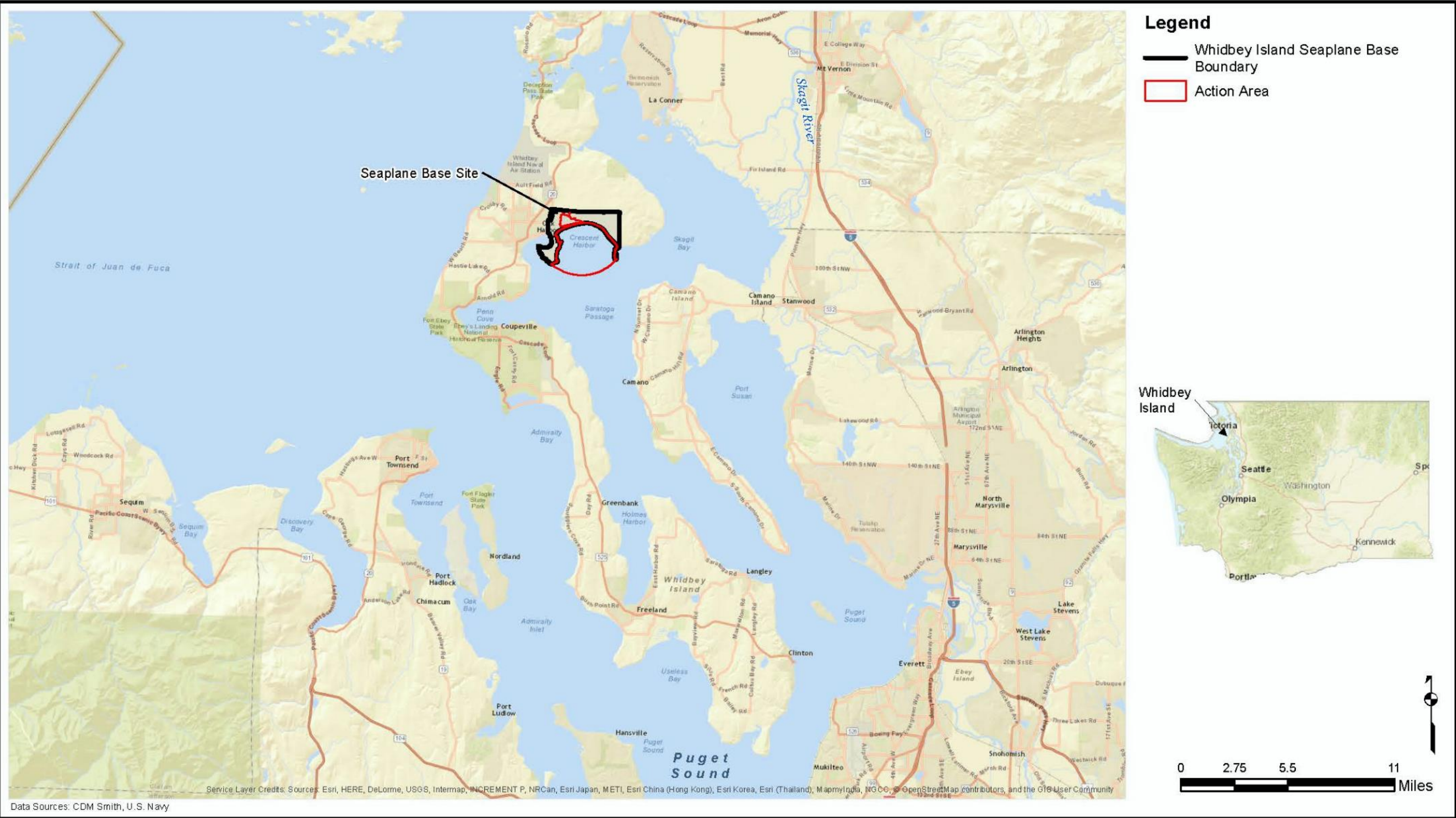


Figure 1-1. Project Vicinity Map

The Seaplane Base supports developed and landscaped areas as well as naturally vegetated areas including wooded areas, freshwater wetlands, salt marshes, and beaches. The project vicinity consists of the City of Oak Harbor to the west, rural residential uses to the north, forested areas to the east, and the marine waters of Crescent Harbor to the south. The Seaplane Base includes residential and institutional land uses, with a small amount of commercial.

1.4 Project Description

The proposed project is for the Navy to operate the existing Seaplane Base WWTP to treat wastewater generated from the Seaplane Base after the City of Oak Harbor releases control and ceases delivery of City-based effluent. The Navy proposes to obtain a new NPDES permit and take over operation of the WWTP to continue to treat domestic and industrial wastewater starting in the fall of 2018 and continuing through 2023. The Navy would discharge treated wastewater in compliance with the Clean Water Act into Crescent Harbor. By 2023, alternatives for long-term management of Seaplane Base wastewater will be fully evaluated and implementation of the selected alternative initiated.

Because the flows will be reduced under Navy management (flows generated from within the City of Oak Harbor service area will be routed to the new Oak Harbor WWTP), the operational characteristics of the WWTP have been reassessed, including a re-evaluation of the acute/chronic dilution zone and water quality based effluent limits. Treatment plant processes will be “right-sized” and some facilities, including the outfall pipe will be repaired. Following the withdrawal of the City’s wastewater, the raw wastewater flows into the plant will drop considerably. The estimated Navy-only average daily flow would be 0.41 million gallons per day (mgd) compared to the current average daily flow of 1.62 mgd. The new NPDES permit will reflect a re-rating of the plant to a maximum monthly permitted capacity of 0.57 mgd. This reduction in permitted capacity changes the plant from a major source to a minor source.

Based on an evaluation of the WWTP, the City has been requested to complete several facility and process modifications before the Navy resumes operation. One important example is that the Navy has requested the City to assess the condition of the lagoon liners and to demonstrate that the lagoons are not adversely impacting the marsh habitat through groundwater discharges. If no significant impacts on the marsh are found, the Navy can continue to use the lagoons as configured, with minor repairs as necessary. Groundwater monitoring would continue in compliance with the permit. The proposed draft NPDES permit provides up to 2.5 years for the Navy to conduct this assessment.

In addition to assessment and minor repairs to the lagoons, the City would begin the process of decommissioning one of the aerated lagoons (assumed to be the northeast lagoon), to reduce excess volume over Navy-only flows. To this end, the City would pump out and dispose of the majority of the sludge within the lagoon. Additional decommissioning activities would be conducted by the Navy as described below as part of the proposed project.

Over the period of this permit cycle (2018 to 2023), the Navy will also modify the plant by conducting activities such as removing aerators, installing smaller equipment, and sealing valves/pipes. Mechanical, electrical, and structural repairs are expected within the fence line, as well as equipment replacements, new yard piping, instrumentation, and process improvements to

increase treatment reliability and meet lower TSS limits expected in the new permit. This process may take several months. These activities are intended to make plant operations more efficient and reduce energy use. There would be no change to the size of the exterior perimeter of the existing plant. Once modified for the projected Navy-only flows and loads, the WWTP's physical design capacity will be less than it is today and will be consistent with the decreased flow.

Influent quality at turnover will be slightly better than the current influent quality, since Navy-only flows are primarily residential/institutional with no heavy industry as compared to the City of Oak Harbor. Therefore, there would be less potential for contaminants such as metals to be found in the influent. The overall effluent quality would remain similar to the current effluent because the proposed action will not result in any major changes in treatment technology.

The Draft Sewer Plan Report summarizes recommendations for both the near-term "Turnover Plan" (the initial 5-year permit cycle) and long term (> 6 years). Near-term recommendations are intended to keep the plant in operation for at least 5 years and will likely include addition of a dechlorination system and basic repairs/replacements but would not include new treatment process technologies. A new chemical feed system is proposed to improve solids removal at the Settling Tanks; this will replace a former ferric sulfate feed system that the City removed from this location. Long-term recommendations will be developed from an alternatives analysis and decision making process using conceptual design information. Long-term alternatives will be developed for Navy-only flows/loads.

The existing outfall will be repaired using a "slipline" method whereby an HDPE liner would be inserted through the existing outfall pipe including the diffuser. A smaller diameter pipe is needed because the volume of effluent will be smaller. The HDPE pipe would be pulled or pushed into the existing outfall pipe via an on-shore pit. This access pit would be constructed on the shore above the mean higher high water and would not be located in the water. Once the new HDPE pipe is in place, divers would construct and attach the diffuser. The existing outfall pipe would remain intact for anchoring and protection of the HDPE pipe. Because the existing outfall pipe will remain in place, sediment disturbance would be minimal and limited to flushing of any sediment that has accumulated inside the outfall pipe. The outfall repair would entail minimal in-water work and construction would take three months or less.

The proposed project covered by this BA is limited to the short-term actions (the initial 5-year permit cycle) and includes the following:

- Continued operation of the WWTP and discharge through the existing outfall, with reduced flow and pollutant loads limited to wastewater generated on the Whidbey Island Seaplane Base
- Repair of the existing outfall by sliplining an HDPE pipe inside the existing outfall pipe and adding a new diffuser
- Decommissioning of one lagoon (assumed to be the northeast lagoon), which would entail decanting the water to the treatment system, removing the lagoon liner and subgrade, and importing clean fill to establish a construction staging area within the lagoon footprint. The lagoon perimeter berm would not be removed.

- Additional actions that may be conducted upon or shortly after turnover if sufficient resources (e.g., funding, staff resources) are available include: headworks flume replacement, surface aerator replacements, settling tank process improvements, plant-wide hydraulic modifications, expansion of the existing on-site hypochlorite generation system capacity, installation of new baffles and dechlorination system in the chlorine contact tank, replacement of the effluent pumps, and plant-wide instrumentation.

The planned work during the Turnover period is described in more detail in Section 4 of the Draft Sewer Plan (CDM Smith 2017). Except for the slipline repair of the existing outfall and discharge of treated effluent, these activities would be conducted within the existing WWTP perimeter berms in developed areas that do not provide habitat for listed species.

In accordance with an NPDES permit, the proposed action will comply with water quality restrictions imposed by EPA and would conform to Washington State standards (Chapter 173-201A Washington Administrative Code [WAC]), which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with Washington's standards is intended to ensure protection of fish and aquatic life to the extent feasible and practicable.

1.5 Avoidance and Minimization Measures

The following avoidance and minimization measures will be implemented to avoid and minimize impacts on listed species, marine mammals, their habitats, and forage species. Best Management Practices (BMPs) are intended to avoid and minimize potential environmental impacts. Additional minimization measures have been developed to protect ESA-listed species, designated critical habitats, and marine mammals.

1.5.1 Construction BMPs

- Work will adhere to performance requirements of the Clean Water Act (CWA) Section 404 permit, CWA Section 401 Water Quality Certification, and other permits. No in-water work will begin until after issuance of regulatory authorizations.
- The construction contractor is responsible for preparation of an Environmental Protection Plan. The plan will be submitted and implemented prior to the commencement of any construction activities and is a binding component of the overall contract. The plan shall identify construction elements and recognize potential spill sources at the site. The plan shall outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The plan shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- A silt/turbidity curtain would be used to confine turbidity within the immediate work area when constructing the in-water portion of the outfall.
- Erosion control devices (e.g., silt fencing, straw wattles, etc.) would be used during on-shore construction activities associated with repair of the outfall to prevent soil from entering Crescent Harbor or other surface waters.
- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials shall be allowed to enter surface waters.

- Washwater resulting from washdown of equipment or work areas shall be contained for proper disposal, and shall not be discharged unless authorized.
- Equipment that enters surface waters shall be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals shall be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. shall be checked regularly for leaks and will be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning shall be discharged to ground or surface waters.
- Construction materials will not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.

1.5.2 Timing Restrictions

The Action Area is within the Washington Department of Fish and Wildlife (WDFW) Tidal Reference Area 8. The approved work windows (WAC 220-660-330) for the Action Area are:

- August 1 to February 15 for juvenile salmon
- March 1 to October 15 for Pacific sand lance
- For surf smelt, authorization is conditional upon inspection, because spawning may occur at any time during the year.

Therefore, to minimize the number of fish exposed to construction disturbance, in-water work will occur from August 1 to October 15, if no surf smelt spawning is observed. Dates are approximate and will be finalized during project design.

1.5.3 Monitoring during Construction

- Conduct biological monitoring during in-water work associated with the outfall repair. To avoid effects on marine mammals during construction, a qualified marine mammal observer will survey an established safety zone around the outfall construction area from on shore or by boat to ensure that no marine mammals are present within the safety zone during construction activities. If a marine mammal is observed within the safety zone, construction activities will be delayed until the marine mammal moves out of the safety zone.

1.6 Conservation Measures

In addition, the following conservation measures are proposed to benefit habitat for salmon and other sensitive species in Crescent Harbor:

- Evaluate long term solutions that would allow for more marsh restoration and/or elimination of the outfall or a reduction in the zone of impact around the outfall.

- Comply with conservation measures in the NAS Whidbey Island INRMP Update (February 2015). These include the following:
 - Chinook Salmon, Bull Trout, Steelhead, Green Sturgeon, and Rockfish Special Management and Protection Requirements: protection measures include in-water work timing restrictions, regular inspections of structures, forage fish spawning surveys to identify important habitat areas for better management and protection, beach cleanups, and invasive species (e.g., *Spartina*) eradication.
 - Killer Whale and Humpback Whale Special Management and Protection Requirements: protection measures include recording areas of use in the waters surrounding NAS Whidbey Island by killer and humpback whales and using the information to update the INRMP and provide management guidance to NAS Whidbey Island's command and departments.
 - Marbled Murrelet Special Management and Protection Requirements: protection measures include surveying for and recording areas of use by marbled murrelets, such as foraging areas along the shore, and using the information to update the INRMP and provide management guidance to NAS Whidbey Island's command for planning military training activities at the installation and adjacent training areas (especially in Crescent Harbor).
 - Habitat management measures for developed areas around the WWTP will include reducing the mowed areas, using native plants for landscaping around buildings, and reducing pesticide/herbicide/fertilizer use.
 - Habitat management measures for marine shoreline areas will include retaining adjacent areas of native marine shoreline riparian vegetation during project actions and enhancing and restoring marine shoreline riparian vegetation affected by the proposed action by replanting vegetation, focusing on known or suitable forage fish spawning areas.

1.7 Consultation History

No previous consultation has occurred for the proposed project. A pre-project meeting was held on November 17, 2016. Participants included the Navy, NMFS, EPA, the Swinomish Tribe, the Skagit River System Cooperative (a natural resource consortium of the Sauk-Suiattle Indian Tribe and the Swinomish Indian Tribal Community), WDFW, and Island County.

1.8 Action Area

For the analysis of the potential effects of the proposed project on listed species, a project Action Area is identified. The Action Area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR §402.02). Thus, observable or measurable effects of the project are not expected beyond the boundaries of the identified project Action Area.

Potential effects from the WWTP effluent discharge into Crescent Harbor may include chronic and acute toxicity to aquatic life. Numerical water quality criteria have been established to avoid these effects. However, these water quality standards are not necessarily protective of listed species.

While direct effects of pollutant discharge covered by the NPDES permit are not anticipated beyond the chronic mixing zone, potential indirect effects such as effects on prey species could occur.

Other potential effects of the proposed project could include effects on habitat for listed species, notably nearshore and tidal marsh habitat important for juvenile salmonids. The Action Area encompasses the area of potential effect on listed species. Therefore, the Action Area is comprised of Crescent Harbor as well as the tidal marsh areas of the Crescent Harbor Salt Marsh adjacent to the WWTP. The Action Area is shown in Figure 1-2.

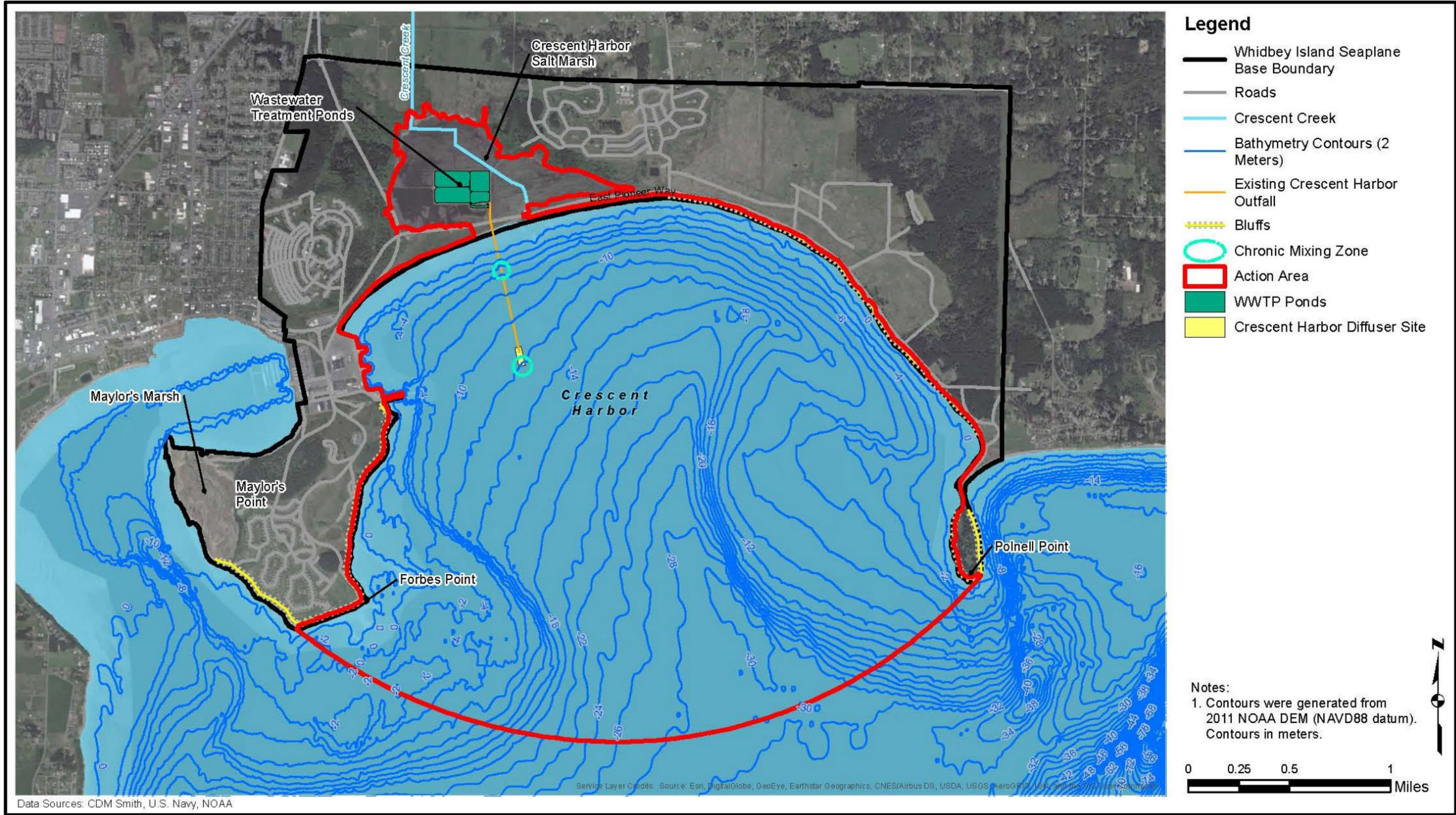


Figure 1-2. Action Area

Section 2

Study Methods

The methodology used to evaluate effects on federally listed species from the proposed project included a review of existing data sources, species life history and distribution information, and a mixing zone analysis.

2.1 Review Existing Data and Studies

The following documents were reviewed for information on the presence and potential presence of federally listed species and critical habitat in the Action Area:

- Integrated Natural Resources Management Plan for the Naval Air Station Whidbey Island, revised February 2015 (Navy 2015)
- NMFS Biological Opinion for the Reissuance of the NPDES permit for Naval Air Station Whidbey Island WWTP (at Ault Field), December 2010 (NMFS 2010a)
- Biological Assessment for Breakwater Construction and Pier Demolition at Naval Air Station Whidbey Island, October 2012 (Navy 2012)
- Additional information on the history and existing conditions of the WWTP facilities and operations at the Seaplane Base

A list of plant, wildlife, and fish species federally listed as endangered, threatened, and/or proposed for listing, and designated critical habitat with the potential to occur in the Action Area was obtained from the sources below. Species lists are provided in Appendix B.

- Federally listed and proposed species from the NMFS West Coast Region website (NMFS 2016a)
- Federally listed and proposed species from the USFWS Information for Planning and Conservation (IPaC) on-line database (USFWS 2016a)
- Designated critical habitat from the USFWS Critical Habitat on-line mapper (USFWS 2016b)

2.2 Mixing Zone Analysis

A mixing zone is the defined area in the receiving water surrounding the discharge port(s) where wastewater mixes with receiving water. Within mixing zones, the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with designated uses of the receiving water body (e.g., recreation, water supply, and aquatic life and wildlife habitat, etc.). The pollutant concentrations outside of the mixing zones must meet water quality numeric standards (Ecology 2011).

Discharge from the WWTP outfall is monitored under an NPDES permit and must meet effluent limits for carbonaceous biochemical oxygen demand (CBOD₅), total suspended solids (TSS), fecal

coliform bacteria, pH, and total residual chlorine. The current discharge permit also establishes a limit on Acute Whole Effluent Toxicity (WET) (Ecology 2011).

2.2.1 Mixing Zone Boundaries

Two levels of exposure are considered for water quality and human health impacts: acute and chronic. Chronic effects are those that can result from long-term exposure to concentrations of a particular pollutant. Acute effects are those that can occur as the result of short-term exposure. These effects are captured in a calculation of the reasonable potential for adverse water quality or human health effects by either chronic or acute exposure.

According to Washington Administrative Code (WAC) 173-201A, the mixing zone dimensions for marine waters are a distance of 200 feet plus the discharge water depth at MLLW. Thus, the mixing zone for the existing Seaplane Base WWTP outfall diffuser is a horizontal distance of 241 feet from all ports (i.e., a circle 484 feet in diameter), at which point chronic water quality standards must be achieved. A smaller mixing zone equal to ten percent of the full mixing zone dimension is also allowed for acute toxicants. The acute mixing zone for the existing diffuser is a horizontal distance of 24.1 feet from all ports (i.e., a circle 48 feet in diameter).

As shown in Figure 1-2, the existing outfall has two chronic mixing zones; one around the location of a leak in the pipe at approximately 990 feet from the shoreline and a depth of about -15 feet MLLW and the other around the diffuser at the end of the pipe. Depending on funding and other circumstances, these conditions may continue for some time into the first 5-year permit period covered by this BA. The draft NPDES permit provides up to three years from permit issuance for the Navy to complete outfall repairs.

2.2.2 Dilution Factors

A mixing zone analysis was conducted for the WWTP discharge expected under Navy-only operation (Cosmopolitan Marine Engineering 2017) and will be reviewed by EPA. The analysis was based on existing NPDES permit conditions, which included two mixing zones, one at the diffuser terminus at a depth of -41 feet MLLW and one at the leak approximately 990 feet from the shoreline at a depth of -15 feet MLLW, where less than 25 percent of effluent flow is discharged. Additional analysis was conducted for the future condition with the outfall repaired, which is expected to occur during the first permit period under Navy operation covered by this BA.

The mixing zone analysis produces numerical values called dilution factors. A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 10 means that the effluent is 10% and the receiving water is 90% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits.

Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much

more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification.

Dilution modeling was conducted by applying Visual Plumes (VP), which is a Windows-based graphical user interface, to a suite of numerical plume models, and the numerical model UM3. Input variables included the 95th percentile values of the measured effluent concentrations for the existing effluent during 2013-2016 for ammonia, CBOD5, fecal coliform, pH, and temperature, as shown in Table 2-1. The maximum concentrations of metals (arsenic, chromium, copper, lead, mercury, nickel, and zinc) in the existing effluent measured in May 2015, August 2015, and October 2015 are shown in Table 2-2. Cadmium, silver, and selenium were non-detectable in the effluent.

UM3 Model results for the proposed plant permitted capacity of 0.57 mgd (maximum month) indicate there would be acute and chronic dilution factors of 163 (10th percentile current speed) and 386 (50th percentile current speed), respectively.

Results for the initial flows at Turnover (i.e. projected for 2018) considering the existing leak in the outfall pipe indicate the acute and chronic dilution factors would be 54.2 and 302, respectively, for the nearshore leak at -15 feet MLLW (25 percent of effluent flow), and 94.5 and 214, respectively for the existing diffuser discharge (75 percent of effluent flow). The acute and chronic dilution factors that would presumably be cited in the NPDES permit would be 54.2 and 214.

Table 2-1. Seaplane Base Plant Effluent Quality Summary (January 2013 to May 2016)

Parameter	Minimum	Average	95 th Percentile	Maximum
Temperature (degrees C)	2.8	13.8	21.5	24.5
pH	6.4	7.2	7.5	7.8
CBOD5 (mg/L)	8.0	16.3	24.0	36
Ammonia, (mg/L as N)	15.0	31.8	44.0	48.0
Chlorine Residual (mg/L)	0.0	0.3	0.45	0.7
Fecal Coliform (MPN/1000 mL)	2	42	178	1,000
Key: C = Celsius mg/L = milligrams per liter MPN = most probable number N = Nitrogen				

2.2.3 Conventional Parameters

Compliance with water quality criteria for conventional parameters, including temperature and pH, was evaluated using spreadsheet calculations developed by Ecology and primarily based upon simple mixing equations. Results of the analyses show that conventional water quality criteria will be met. As stated in fact sheet for the existing permit (Ecology 2011), based on the large amount of

dilution in the receiving water at critical conditions, technology based effluent limits for CBOD are sufficient to ensure that water quality criteria for dissolved oxygen are met.

2.2.4 Reasonable Potential Analysis

The reasonable potential to exceed water quality standards is a standard statistical test developed by the EPA and Ecology to establish the need for effluent limits in NPDES permits. Reasonable potential analysis (RPA) procedures are outlined in the Permit Writer' Manual (Ecology 2015).

In addition to anticipated dilution values, the RPA requires effluent and ambient water data as input data. The reasonable potential of the effluent to exceed water quality criteria for ammonia, chlorine residual, and metals was assessed for the revised permitted capacity (0.57 mgd MMF) with the outfall repaired (sliplined) based on existing effluent data collected from 2013-2016 (2015 for metals). It is assumed that the effluent quality following withdrawal of the City will be similar to past effluent quality because the treatment technology will be the same even though the volume and loading will be greatly reduced. This is a conservative assumption because the Navy-only wastewater contains a smaller proportion of industrial user inputs than wastewater from the City's service area. The reasonable potential analysis found that there is no reasonable potential to exceed water quality criteria, as shown in Table 2-2.

Table 2-2. Reasonable Potential Analysis Results Summary (Plant Permitted Capacity with Repaired Outfall)

Parameter	Ambient Conc. (ug/L)	Effluent Conc. (ug/L)	State Water Quality Standard		Maximum Concentration at Mixing Zone Boundary		RPA Ratio		Reasonable Potential Limit Required?
			Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	
Ammonia, Criteria as Total NH ₃	90	44,000	11,980	1,800	359	204	0.03	0.11	NO
Chlorine (Total Residual)	0	450	13	7.5	2.761	1.166	0.21	0.16	NO
Arsenic	0	0.9	69	36	0.017	0.007	0.00	0.00	NO
Chromium (hex)	0	0.06	1,100	50	0.001	0.000	0.00	0.00	NO
Copper	0	14	4.8	3.1	0.214	0.090	0.04	0.03	NO
Lead	0	0.5	210	8.1	0.009	0.004	0.00	0.00	NO
Mercury	0	0.2	1.8	0.025	0.003	0.002	0.00	0.08	NO
Nickel	0	4	74	8.2	0.073	0.031	0.00	0.00	NO
Zinc	0	28	90	81	0.487	0.206	0.01	0.00	NO

Using the lower dilution factors for the existing condition of the outfall with the near-shore break, the reasonable potential analysis found that there is no reasonable potential to exceed water quality criteria under those conditions. This is shown in Table 2-3.

Table 2-3. Reasonable Potential Analysis Results Summary (2018 Flows with “As-Is” Outfall)

Parameter	Ambient Conc. (ug/L)	Effluent Conc. (ug/L)	State Water Quality Standard		Maximum Concentration at Mixing Zone Boundary		RPA Ratio		Reasonable Potential Limit Required?
			Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	Acute (ug/L)	Chronic (ug/L)	
Ammonia, Criteria as Total NH ₃	90	44,000	11,980	1,800	928	295	0.08	0.16	NO
Chlorine (Total Residual)	0	450	13	7.5	8.588	2.103	0.66	0.28	NO
Arsenic	0	0.9	69	36	0.052	0.013	0.00	0.00	NO
Chromium (hex)	0	0.06	1100	50	0.003	0.001	0.00	0.00	NO
Copper	0	14	4.8	3.1	0.665	0.163	0.14	0.05	NO
Lead	0	0.5	210	8.1	0.027	0.007	0.00	0.00	NO
Mercury	0	0.2	1.8	0.025	0.010	0.003	0.01	0.12	NO
Nickel	0	4	74	8.2	0.227	0.056	0.00	0.01	NO
Zinc	0	28	90	81	1.516	0.371	0.02	0.00	NO

Section 3

Environmental Setting

This section describes the environmental setting for the proposed action.

3.1 Regional Setting

The proposed action is located on Whidbey Island, approximately 20 miles north of Seattle, Washington, in Puget Sound. Whidbey Island has a mid-latitude west coast marine climate that is characterized by moist, mild winters and by cool, dry summers. The island receives less annual precipitation than nearby regions because it lies in the rain shadow of the Olympic Mountain Range, which is located southwest of the island on the Olympic Peninsula (Navy 2015).

The west side of Whidbey Island is exposed to wind and wave action from the Strait of Juan de Fuca and is characterized by high eroding bluffs that feed cobble and sand beaches. The shore along the protected east side of the island is comprised of mostly stable gravel and mud beaches.

3.2 Project Setting

The Seaplane Base WWTP is currently located within a coastal salt marsh, known as the Crescent Harbor Salt Marsh (Skagit River System Cooperative 2016). As described in Section 1.8, the project Action Area also includes the area of potential effects surrounding the WWTP outfall in Crescent Harbor as well as the tidally influenced salt marshes that provide habitat for salmon and other marine species.

3.2.1 WWTP Facilities and Upland Habitats

The Seaplane Base WWTP includes developed areas with buildings, paved roads and parking lots and landscaped areas. WWTP facilities include the wastewater ponds, berms, and pipelines. Upland habitats on the Seaplane Base include grasslands, agricultural lands, scrub shrub and forest habitats (Navy 2015).

3.2.2 Aquatic Habitat

3.2.2.1 Crescent Harbor Salt Marsh

The Crescent Harbor Salt Marsh is part of a group of nearshore habitats referred to as pocket estuaries. Pocket estuaries are partially enclosed bodies of marine water that are connected to a larger estuary (such as Puget Sound) at least part of the time and are diluted by freshwater from the surrounding upland watershed at least part of the year (Beamer et al. 2016). The Crescent Harbor pocket estuaries provide an important habitat for Chinook salmon fry once they leave their natal estuary early in the year and enter nearshore areas of the Whidbey Basin (Beamer et al. 2003; Beamer et al. 2006).

The salt marsh and surrounding shrub lands also provide valuable habitat for a variety of raptors, waterfowl, and songbirds. Shorebirds utilize the beach and mudflat areas (Navy 2015).

Prior to 1905, the Crescent Harbor Salt Marsh was hydraulically connected to Crescent Harbor by a channel located in the southwestern portion of the marsh. In 1905, the marsh was diked and ditched for agricultural use, and the channel inlet was filled and replaced with a tidegate in the southeastern portion of the marsh (Skagit River System Cooperative 2016).

In 2009, the Navy partnered with the Skagit River System Cooperative to restore the tidal salt marsh. As part of the restoration, the outlet channel tide gate was replaced with a bridge, thus restoring tidal flooding and fish access to more than 200 acres of Crescent Harbor Salt Marsh (Figure 3-1). In addition, tidal connectivity within the historic marsh area was increased by creating notched weirs in the sewer intake dikes separating salt marsh cells on both the west and east sides of the marsh. A small culvert connecting the southwest and east salt marsh cells was also replaced to improve fish access and tidal circulation (Skagit River System Cooperative 2016). Scouring and erosion of the channel connecting the salt marsh to Crescent Harbor is a concern, especially for the berm carrying the Crescent Capehart Housing Facility sewer pipeline. In 2015, the Navy conducted repairs to armor the berm to protect the pipeline. The Navy plans to replace the berm and armoring with piles, and will allow the berm materials to wash away naturally, improving tidal circulation over time.

3.2.2.2 Maylor's Marsh

Maylor's Marsh is an intertidal salt marsh located at the western end of the Seaplane Base, south of Oak Harbor and just northwest of Maylor Point (Figure 1-2). Maylor's Marsh has been disturbed with dikes and ditches but supports some native coastal salt marsh vegetation and common vertebrate and invertebrate species (Navy 2015). Maylor's Marsh is outside of the Action Area because its location makes it more hydrologically connected to Oak Harbor than Crescent Harbor, but it is still an important component of the habitat context for species using Crescent Harbor.

3.2.2.3 Freshwater Marshes and Streams

Freshwater marshes and streams occur around the perimeter of Crescent Harbor salt marsh (Figure 3-1). Streams and other surface waters include a large main drainage ditch adjacent to the sewage disposal ponds, roadside and field ditches, and small drainages in the grassy areas around the housing units. Other surface waters include the sewage disposal ponds, Penfold Pond, and a small pond to the south of the fuel farm (Navy 2015). Crescent Creek and the outflow from Penfold Pond flow into the Crescent Harbor Salt Marsh (Navy 2015). Penfold Pond collects water from a spring and from stormwater runoff from the Crescent Capehart residential area. Crescent Creek originates at a spring approximately 1.3 miles north of the Seaplane Base boundary. Therefore, the watershed surrounding the marsh is relatively small.

Freshwater habitats at the Seaplane Base support amphibians and reptiles including Pacific treefrog and potentially northwestern pond turtle, and three species of garter snakes (Navy 2015).

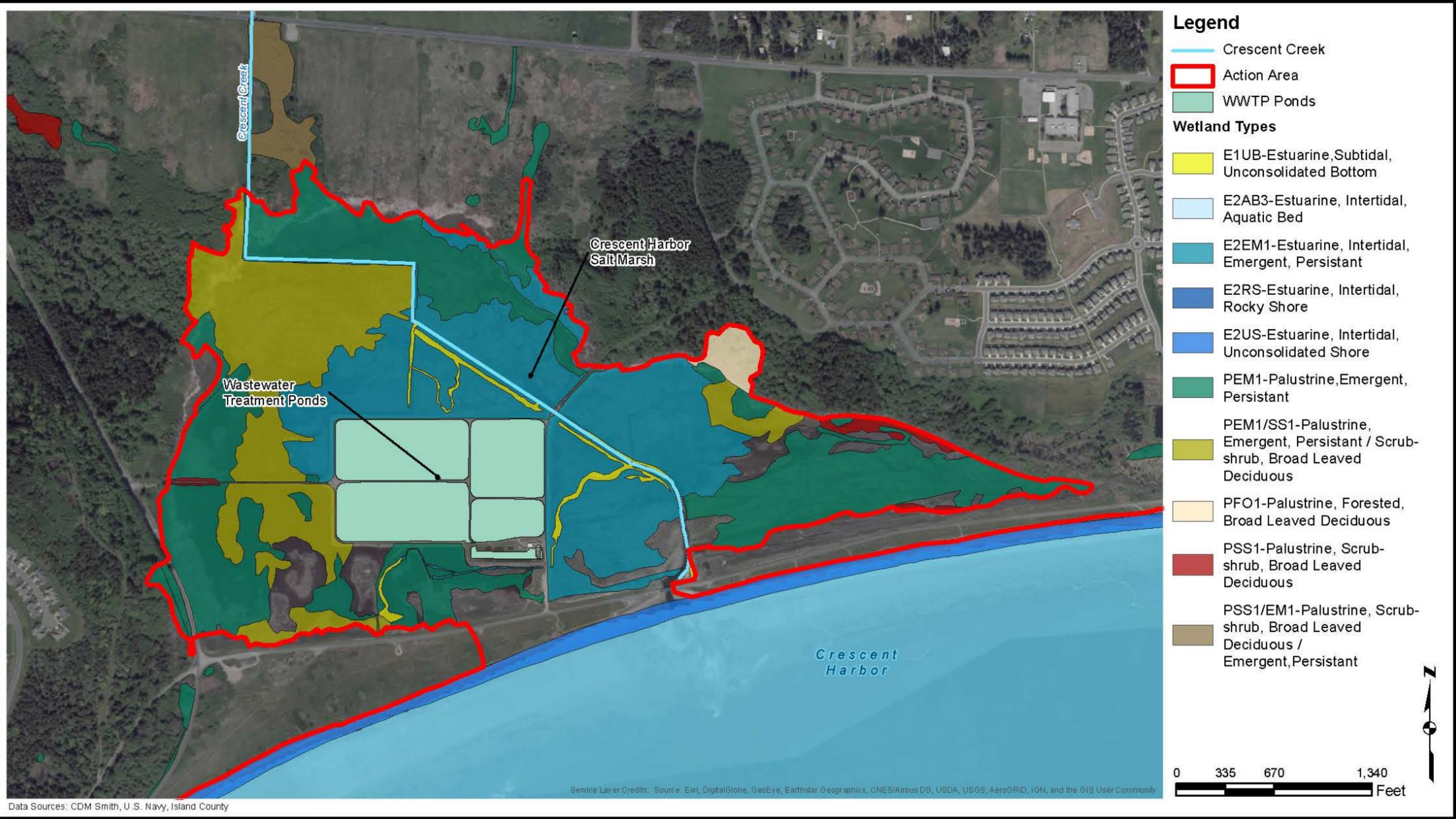


Figure 3-1. Crescent Harbor Salt Marsh Wetland Types

3.2.2.4 Crescent Harbor

Crescent Harbor supports tidal mud flats along its northern shore and provides spawning habitat for forage fish, including sand lance and surf smelt (Navy 2015). The beach consists predominantly of coarse sand and cobble. Beach habitats and the associated shallow nearshore environment are important for forage fish, juvenile salmon, shellfish, and aquatic vegetation such as eelgrass and kelp beds. Bluffs and rocky shore habitats are also present along the edges of the harbor (Figure 1-2 and Figure 4-1).

In Puget Sound, bluff erosion is the primary source of material that replenishes beach substrate. The composition of contributing bluffs and the amount of wave energy exposure determines the type and size of material that collects on a beach and forms the substrate. Beach evolution also defines the structure and composition of the marine backshore where marine riparian vegetation grows, which in turn provides a separate unique range of habitat types for both aquatic and terrestrial species (Aquatic Habitat Guidelines Program 2010).

Frierson et al. (2016) observed that most of the benthic habitat in Crescent Harbor consisted of featureless mud and sand. However, they noted habitat features including cobble, boulders, bull kelp, and eelgrass in the nearshore areas adjacent to Forbes and Polnell Points. Harbor seals use off-shore rocks near the ends of Crescent Harbor for haulouts (Navy 2015).

3.3 Listed Species and Critical Habitat Present in the Project Area

Table 3-1 lists the federally listed species identified by federal and state databases as having potential to occur in the project Action Area. Appendix B contains the species lists from NMFS and USFWS. Designated critical habitat in the Action Area is also identified in Table 3-1.

Department of Defense (DoD) lands/waters are excluded from designated critical habitat under Section 4(a)(3)(B)(i) of the ESA (16 U.S.C. 1533(a)(3)(B)(i)), as revised in 2003, when an integrated natural resources management plan (INRMP) prepared under section 101 of the Sikes Act Improvement Act of 1997 (16 U.S.C. 670a) provides a benefit to the species for which critical habitat is proposed for designation. There is an adopted INRMP in place for Whidbey Island Seaplane Base (Navy 2015), and Crescent Harbor is excluded from critical habitat designations. However, for species with the potential to occur within the Action Area, the critical habitat designation provides a framework for the evaluation of effects. Therefore, critical habitat is noted in Table 3-1 when it would ordinarily be included in the Action Area but for the adoption of the INRMP. Additional information regarding the distribution and likely presence of the species listed in Table 3-1 in the Action Area is discussed in the following sections.

Table 3-1. ESA Species and Critical Habitat Potentially Present within the Action Area

Common Name	Scientific Name	Status	Critical Habitat Designated	Potential for Species to Occur in Action Area
Fish				
Puget Sound Chinook Salmon ESU	<i>Oncorhynchus tshawytscha</i>	T	Critical habitat designated in Action Area; however, Navy waters are excluded.	Potential to occur
Puget Sound DPS of Steelhead	<i>Oncorhynchus mykiss</i>	T	Not in Action Area	Potential to occur
Coastal-Puget Sound DPS of Bull Trout	<i>Salvelinus confluentus</i>	T	Critical habitat designated in Action Area; however, Navy waters are excluded.	Potential to occur
Southern DPS of North American Green Sturgeon	<i>Acipenser medirostris</i>	T	Not in Action Area	Potential to occur
Southern DPS of Pacific Eulachon	<i>Thaleichthys pacificus</i>	T	Not in Action Area	Potential to occur
Puget Sound/Georgia Basin DPS of Bocaccio Rockfish	<i>Sebastes paucispinis</i>	E	Critical habitat designated in Action Area; however, Navy waters are excluded.	Potential to occur
Puget Sound/Georgia Basin DPS of Canary Rockfish	<i>Sebastes pinniger</i>	Delisted March 24, 2017	Critical habitat designation removed March 24, 2017.	Potential to occur
Puget Sound/Georgia Basin DPS of Yelloweye Rockfish	<i>Sebastes ruberrimus</i>	T	Critical habitat designated in Action Area; however, Navy waters are excluded.	Potential to occur
Birds				
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	T	Not in Action Area	Potential to occur in aquatic habitat
Northern Spotted Owl	<i>Strix occidentalis caurina</i>	T	Not in Action Area	Unlikely; no suitable habitat.
Streaked Horned Lark	<i>Eremophila alpestris strigata</i>	T	Not in Action Area	Unlikely; no suitable habitat.
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	T	Not in Action Area	Unlikely; no suitable habitat.

Common Name	Scientific Name	Status	Critical Habitat Designated	Potential for Species to Occur in Action Area
Mammals				
Southern Resident DPS of Killer Whale	<i>Orcinus orca</i>	E	Critical habitat designated in Action Area; however, Navy waters are excluded.	Potential to occur
North Pacific Humpback whale	<i>Megaptera novaeangliae</i>	E	Not designated	Potential to occur
Plants				
Golden Paintbrush	<i>Castilleja levisecta</i>	T	Not designated	Unlikely; no suitable habitat.

Source: U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) Website, Accessed November 8, 2016. National Marine Fisheries Service (NMFS), West Coast Region Website, Accessed November 8, 2016. Removal of the Puget Sound/Georgia Basin Distinct Population Segment of Canary Rockfish From the Federal List of Threatened and Endangered Species and Removal of Designated Critical Habitat, Federal Register 82:7711-7731.

Key:

DPS = Distinct Population Segment

ESU = Evolutionarily Significant Unit

E = Endangered

T = Threatened

3.3.1 Puget Sound Chinook Salmon ESU

3.3.1.1 Species Status and Life History

The Puget Sound ESU of Chinook salmon (*Oncorhynchus tshawytscha*) was listed as threatened on March 24, 1999 (National Marine Fisheries Service [NMFS] 1999). Primary factors contributing to declines in Chinook salmon in the Puget Sound ESU include habitat blockages, hatchery introgression, urbanization, logging, hydropower development, harvests, and flood control developments (NMFS 1998).

The life history of Puget Sound Chinook salmon is described in detail in the NMFS *Technical Memorandum NMFS-NWFSC-35 Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California* (Myers et al., 1998) and is included herein by reference. This information has been summarized in Appendix C.

3.3.1.2 Occurrence in the Action Area

To the east of Whidbey Island there are three primary estuarine rearing areas for Chinook salmon associated with the Skagit, the Stillaguamish, and the Snohomish rivers. Juvenile Chinook using the water resource inventory area (WRIA) 6 nearshore could originate from many of the Puget Sound watersheds; however, it is assumed that most outmigrate from the Skagit River system (WSCC 2000). There are no streams in WRIA 6 of sufficient size or flow to provide spawning habitat for adult Chinook; however, juveniles may use the lower stream reaches for rearing (WSCC 2000).

Chinook salmon are known to leave these estuaries in the late spring months when they are one to six inches in length and tend to migrate along sloping beaches with a preference for beaches with

structure and macrophytic vegetation, which are utilized as foraging and refugia areas (NMFS 2006a). Eelgrass and kelp along the east shoreline of Crescent Harbor within the Action Area may provide important habitat for juvenile Chinook salmon. WDFW conducted fish surveys of the Action Area in 2014 and 2015 (Frierson et al. 2016). They captured juvenile Chinook salmon with a beach seine in the Action Area.

Beamer et al. (2016) documented juvenile Chinook salmon using Crescent Harbor Salt Marsh early in the year at higher densities than the adjacent nearshore habitat. They found that the rearing period when juvenile Chinook are present in higher densities than adjacent nearshore habitat is more abbreviated than some other pocket estuaries within the Whidbey Basin. They postulated that the shorter period may be related to environmental conditions, especially the low dissolved oxygen and higher temperatures observed within the marsh that coincide with the time period when juvenile Chinook salmon densities begin to decline in May or June (Beamer et al. 2016).

3.3.1.3 Critical Habitat in Action Area

Critical habitat was initially designated for Puget Sound Chinook on February 16, 2000, and was revised on September 2, 2005 (NMSF 2000; NMSF 2005a). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches and extends from the line of high tide out to a depth of 30 meters (m) below the MLLW (NMSF 2005a). The shoreline areas of Crescent Harbor and the Whidbey Island Seaplane Base are excluded from the critical habitat designation, including the entire Action Area.

3.3.2 Puget Sound DPS of Steelhead

3.3.2.1 Species Status and Life History

The Puget Sound Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) was listed as threatened on May 11, 2007 (NMFS 2007a). Possible factors influencing the depletion of Puget Sound steelhead populations include habitat destruction and fragmentation, inadequate regulation of hatchery practices and land use activities, and potential genetic mixing between hatchery - and natural-origin steelhead.

The life history of Puget Sound steelhead is described in the *Proposed Endangered Status for Five ESUs of Steelhead and Proposed Threatened Status for Five ESUs of Steelhead in Washington, Oregon, Idaho, and California* (NMFS 1996) and is included herein by reference. This information has been summarized in Appendix C.

3.3.2.2 Occurrence in the Action Area

Steelhead do not occur in WRIA 6 streams (WSCC 2000). Steelhead in the Puget Sound DPS are most abundant in northern Puget Sound, with winter-run steelhead in the Skagit and Snohomish rivers supporting the two largest populations (NMFS 2007a). Wild juvenile steelhead typically spend two full years in freshwater before outmigrating during the spring. Because of their larger size at outmigration, steelhead do not typically spend a large amount of time in the nearshore, rather they tend to quickly outmigrate to open water (NMFS 2005b). Therefore, steelhead are unlikely to be present in the Action Area, but, if present, would most likely occur in offshore waters of Crescent Harbor, which would include waters in and around the outfall.

3.3.2.3 Critical Habitat in Action Area

The final rule to designate critical habitat for the Puget Sound steelhead became effective on March 25, 2016. Streams on and adjacent to Whidbey Island were not designated as critical habitat, therefore, the proposed Action Area does not contain critical habitat for the Puget Sound DPS of steelhead (NMFS 2016b).

3.3.3 Coastal-Puget Sound DPS of Bull Trout

3.3.3.1 Species Status and Life History

Bull trout (*Salvelinus confluentus*) were listed as threatened by the United States Fish and Wildlife Service (USFWS 1999) on December 1, 1999.

The life history of the Coastal-Puget Sound DPS Bull Trout is described in the *Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for Bull Trout in the Coterminous U.S.; Final Rule* (USFWS 1999) and is included herein by reference. This information has been summarized in Appendix C.

3.3.3.2 Occurrence in the Action Area

There are no spawning streams on Whidbey Island, so bull trout found along the shores of Whidbey Island would likely originate in the Skagit, Stillaguamish, and Snohomish river systems and be traveling along the shorelines foraging for food. It is unknown if bull trout from Olympic Peninsula/Straits of Juan de Fuca streams would migrate across the deep open waters to Whidbey Island. Only adult bull trout were captured with the beach seine in the Action Area in 2014 and 2015 (Frierson et al. 2016).

The limited data available for stocks in the larger Snohomish and Skagit River Basins indicates that bull trout have annual migrations to marine areas beginning in late winter and peaking in spring to mid-summer (Pentec 2000). It is believed that these larger sub-adult and adult bull trout migrate to marine areas occupying shallow nearshore habitats (USFWS 2016c). Most anadromous bull trout appear to move back to fresh water by late summer; however, the beach seine study in Crescent Harbor captured one adult bull trout in June and one in November (Frierson et al. 2016).

3.3.3.3 Critical Habitat in the Action Area

Critical habitat for the bull trout was designated on November 17, 2010 and included 442.5 miles of marine shorelines within Puget Sound. This includes most of the perimeter of Whidbey Island and extends offshore to a depth of 33 feet below MLLW (USFWS 2010). The Action Area is excluded from the critical habitat designation.

3.3.4 Puget Sound/Georgia Basin DPS of Bocaccio Rockfish

3.3.4.1 Species Status and Life History

The Puget Sound/Georgia Basin DPS of bocaccio rockfish (*Sebastes paucispinis*) was listed as endangered on July 27, 2010 (NMFS 2010b). The primary factors influencing the decline of the Puget Sound/Georgia Basin DPS bocaccio rockfish are overfishing, habitat degradation, and degraded water quality including low dissolved oxygen and elevated levels of contaminants (NMFS 2010b).

The life history of bocaccio rockfish is described in the *Proposed Endangered Threatened and Not Warranted Status for Distinct Population Segments of Rockfish in Puget Sound* (NMFS 2009a) and the *Preliminary Scientific Conclusions of the Review of the Status of 5 Species of Rockfish: Bocaccio (Sebastes paucispinis), Canary Rockfish (Sebastes pinniger), Yelloweye Rockfish (Sebastes ruberrimus), Greenstriped Rockfish (Sebastes elongatus) and Redstripe Rockfish (Sebastes proriger) in Puget Sound, Washington* (NMFS 2009b) and is included herein by reference. This information has been summarized in Appendix C.

3.3.4.2 Occurrence in the Action Area

Bocaccio rockfish are considered deepwater species and are often associated with steep slopes of sand or rocky substrates (Miller and Borton 1980). A 1980 study showed two instances of bocaccio rockfish in the Whidbey Basin as compared to 104 in the Central Sound (Palsson et al. 2009).

WDFW conducted fish surveys of the Action Area in 2014 and 2015 (Frierson et al. 2016). They observed very few rockfish, with no ESA-listed species of rockfish observed. They also observed that the habitat and depth of the survey area were not consistent with known associations of ESA-listed rockfish species elsewhere in Puget Sound. Based on those observations, they concluded that the Action Area is unlikely to support adult ESA-listed rockfish species. However, eelgrass beds and kelp growth on harder substrates in the eastern corner of the Action Area could provide productive rearing habitat for juvenile rockfish, particularly juvenile bocaccio rockfish (NMFS 2016c).

3.3.4.3 Critical Habitat in the Action Area

Critical Habitat for the bocaccio rockfish took effect on February 11, 2015 (NMFS 2014). Rockfish nearshore critical habitat includes the nearshore areas of eastern Whidbey Island including Penn Cove, Oak Harbor, and Crescent Harbor. The Action Area is excluded from this designated critical habitat.

3.3.5 Puget Sound/Georgia Basin DPS of Yelloweye Rockfish

3.3.5.1 Species Status and Life History

The Puget Sound/Georgia Basin DPS of yelloweye rockfish (*Sebastes ruberrimus*) was listed as threatened on July 27, 2010 (NMFS 2010b). The primary factors influencing the decline of the Puget Sound/Georgia Basin DPS yelloweye rockfish are overfishing, habitat degradation, and degraded water quality including low dissolved oxygen and elevated levels of contaminants (NMFS 2010b).

The life history of yelloweye rockfish is described in the *Proposed Endangered Threatened and Not Warranted Status for Distinct Population Segments of Rockfish in Puget Sound* (NMFS 2009a) and the *Preliminary Scientific Conclusions of the Review of the Status of 5 Species of Rockfish: Bocaccio (Sebastes paucispinis), Canary Rockfish (Sebastes pinniger), Yelloweye Rockfish (Sebastes ruberrimus), Greenstriped Rockfish (Sebastes elongatus) and Redstripe Rockfish (Sebastes proriger) in Puget Sound, Washington* (NMFS 2009b) and is included herein by reference. This information has been summarized in Appendix C.

3.3.5.2 Occurrence in the Action Area

Yelloweye rockfish are a sedentary, deepwater species that are associated with high relief rocky habitats and are often found near steep slopes (Miller and Borton 1980). There are very few

accounts of yelloweye rockfish in or near the Action Area; the majority of sightings in Puget Sound have been near the San Juan Islands (Palsson et al. 2009, NMFS 2016c).

Based on the habitats present in the Action Area and the results of the WDFW study, the Action Area is unlikely to support adult ESA-listed rockfish species or their preferred deep-water habitats. However, eelgrass beds and kelp areas in the eastern corner of the Action Area could provide productive rearing habitat for juvenile rockfish (Frierson et al. 2016).

3.3.5.3 Critical Habitat in the Action Area

Critical Habitat for the yelloweye rockfish took effect on February 11, 2015 (NMFS 2014). Rockfish nearshore critical habitat includes the nearshore areas of eastern Whidbey Island including Penn Cove, Oak Harbor, and Crescent Harbor. The Action Area is excluded from this designated critical habitat.

3.3.6 Southern DPS of North American Green Sturgeon

3.3.6.1 Species Status and Life History

The Southern DPS of green sturgeon (*Acipenser medirostris*) was listed as threatened on June 6, 2006 (NMFS 2006b). The primary factors responsible for the decline of the Southern DPS green sturgeon are the destruction and modification of habitat (NMFS 2005c).

The life history of the Southern DPS green sturgeon is described in the *Proposed Threatened Status for the Southern Distinct Population Segment Green Sturgeon* (NMFS 2005c) and in the 2002 and 2005 *Status Review for the North American Green Sturgeon, Acipenser medirostris* (Adams et al. 2002; Adams et al. 2005) and is included herein by reference. This information has been summarized in Appendix C.

3.3.6.2 Occurrence in the Action Area

The southern DPS of green sturgeon occur from Puget Sound to Monterey Bay, California. In an electronic tagging study, researchers found lower numbers of green sturgeon in Puget Sound in the winter and summer months compared to other bays south of the Strait of Juan de Fuca (Lindley et al. 2011). Green sturgeon have not been documented in Crescent Harbor, but may infrequently occur in the Action Area.

3.3.6.3 Critical Habitat in the Action Area

Critical Habitat for the southern DPS of green sturgeon was designated on November 8, 2009 and ranges from Monterey Bay, CA to Cape Flattery, WA, including the Strait of Juan de Fuca at a depth of 60-fathoms (360 feet/110 meters). This includes parts of the western shore of Whidbey Island but does not include the Action Area on the east side of the island (NMFS 2009c).

3.3.7 Southern DPS of Pacific Eulachon

3.3.7.1 Species Status and Life History

The southern DPS of Pacific eulachon (*Thaleichthys pacificus*) was listed as a threatened species under the Endangered Species Act on May 17, 2010 (NMFS 2010c).

The life history of the Southern DPS Pacific eulachon is described in the *Critical Habitat for the Southern Distinct Population Segment of Eulachon, Final Biological Report* (NMFS 2011a) and is included herein by reference. This information has been summarized in Appendix C.

3.3.7.2 Occurrence in the Action Area

Puget Sound is not known to support an established population of eulachon, although instances of the fish's presence have been recorded (NMFS 2010c). Occurrence within the Action Area would be unlikely.

3.3.7.3 Critical Habitat in the Action Area

Critical habitat for the southern DPS of the Pacific eulachon was designated on December 19, 2011 (NMFS 2011b). Critical habitat covers the states of California, Oregon, and Washington, excluding any tribal lands. The western portion of Whidbey Island is designated as critical habitat. There is no designated critical habitat in the Action Area, which is on the eastern side of the island.

3.3.8 Marbled Murrelet

3.3.8.1 Species Status and Life History

The marbled murrelet (*Brachyramphus marmoratus*) was federally listed as threatened on October 1, 1992 (USFWS 1992).

The life history of the marbled murrelet is described in the *Final Designation of Critical Habitat for the Marbled Murrelet; Final Rule* (USFWS 1996) and is included herein by reference. This information has been summarized in Appendix C.

3.3.8.2 Occurrence in the Action Area

Marbled murrelets can occur year-round in Puget Sound, although their flock size, density, and distribution vary by season (Nysewander et al. 2005; Falxa et al. 2008). The presence of marbled murrelets during the breeding season in Crescent Harbor and vicinity has been documented during monitoring conducted under the Northwest Forest Plan Murrelet Effectiveness Monitoring Program (Raphael et al. 2007) and the Puget Sound Ambient Monitoring Program conducted by WDFW (Nysewander et al. 2005).

3.3.8.3 Critical Habitat in the Action Area

Critical habitat for nesting marbled murrelets was designated in 1996 (USFWS 1996) and proposed for revision in 2008 (USFWS 2008). Critical habitat in Oregon and California was revised in the final rule (USFWS 2011). The Action Area is not within designated critical habitat (USFWS 1996, 2011).

3.3.9 Southern Resident DPS of Killer Whale

3.3.9.1 Species Status and Life History

The Southern Resident DPS of killer whales (*Orcinus orca*) was listed as endangered in 2005 (NMFS 2005d). Possible factors influencing the decline of Southern Resident killer whale populations include high levels of contamination, reduced availability of prey, and increased whale-watching activities near the San Juan Islands (NMFS 2016d).

The life history and habitat requirements of killer whales are described in the *Washington State Status Report for the Killer Whale* (Wiles 2004) and also in NMFS (2005c) and are included herein by reference. This information has been summarized in Appendix C.

3.3.9.2 Occurrence in the Action Area

The southern resident population is made up of three pods, J, K, and L, which spend time in the Strait of Juan de Fuca and Puget Sound from the late spring into fall (NMFS 2006c). They may be found anywhere within Puget Sound as they follow salmon migration patterns.

Killer whales are frequently seen in Saratoga Passage, although, it is not always possible to determine from the reports whether they are Southern Resident whales or transients (ORCA Network 2017). Transients may be more often spotted in and around Crescent Harbor due to the presence of marine mammals, the primary prey for transients; whereas, Southern Residents rely primarily on salmon and other fish as a source of food. The lack of large salmon producing rivers on Whidbey Island likely limits the presence of Southern Residents in its nearshore bays and estuaries.

3.3.9.3 Critical Habitat in the Action Area

Critical habitat for the Southern Resident killer whale was designated on December 29, 2006 (NMFS 2006c). This designation includes three areas: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca. This area makes up approximately 2,560 square miles of marine habitat at a depth of greater than 20 feet relative to extreme high water, but excludes approximately 112 square miles of military sites (NMFS 2006c). The Action Area is excluded from designated critical habitat.

3.3.10 North Pacific Humpback Whale

3.3.10.1 Species Status and Life History

In the North Pacific, there are three DPSs of humpback whales (*Megaptera novaeangliae*) that feed along the Pacific coast. These include the Western North Pacific, Hawaii, Mexico, and Central America DPS. The Mexico DPS was listed as threatened, while the Western North Pacific and Central America DPSs were listed as endangered effectively on October 11, 2016 (NMFS 2015).

The life history of the humpback whale is described in *The Final Recovery of the Humpback Whale* (NMFS 1991), and is included herein by reference. Life history information has been summarized in Appendix C.

3.3.10.2 Occurrence in the Action Area

Once common in Washington state inland waters, the humpback whale has only been intermittently sighted and is considered a rare visitor in Puget Sound (Miller et al. 2009). While humpback whale abundance is rare within the inland waters of Puget Sound and the Straits of Georgia and Juan de Fuca, it is anticipated that individual whales could occur within the Action Area foraging or migrating to/from breeding and feeding areas, although in extremely low numbers.

3.3.10.3 Critical Habitat in the Action Area

There is no designated critical habitat for the humpback whale.

Section 4

Environmental Baseline Condition

The following section describes the environmental baseline condition. The environmental baseline is defined as the existing condition of the habitat for each listed species. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation of this proposed action (50 CFR§402.02).

Any proposed action must be evaluated in the context of the existing environmental baseline to determine whether the proposed action, when added to the “present and future human and natural contexts,” will jeopardize listed species (National Wildlife Federation [NWF] v. NMFS) 524 F.3d 917 at 930 (Ninth Circuit Court 2007). Where baseline conditions imperil a species, a new action can be taken as long as it does not “cause some new jeopardy” or “deepen the jeopardy by causing additional harm,” or cause “some deterioration in the species’ pre-action condition” NWF v NMFS, 524 F.3 at 930.

The Proposed Action is the operation of the Seaplane Base WWTP to treat only the wastewater that is generated by the Navy from the Seaplane Base residents and operations. The baseline condition would reflect the current condition under which the WWTP treats wastewater from both the Seaplane Base and the City of Oak Harbor service area. The baseline condition reflects a much higher volume of wastewater discharge to Crescent Harbor.

4.1 Seaplane Base WWTP

Currently, the Seaplane Base WWTP receives a mixture of raw sewage and RBC plant effluent from the City of Oak Harbor, in addition to the domestic wastewater flows from the Navy’s Seaplane Base. Under City operation, the WWTP serves approximately 24,000 people within the City and the Navy’s Seaplane Base. A survey conducted for the Comprehensive Sewer Plan (Tetra Tech 2008) found that Oak Harbor’s mix of residential, commercial, and industrial uses is generally consistent with that of similar communities in the State of Washington.

Under the Proposed Action, the WWTP would only serve the Navy’s Seaplane Base with a developed and sewered area of approximately 1,600 acres. The population in 2016 was estimated to be 5,756. The land used for residential housing is grouped into three main housing areas: Saratoga, Maylor Point, and Crescent Capehart. The operational, commercial and support areas of the Seaplane Base are situated on the isthmus separating Oak and Crescent harbors. The Industrial/Commercial area includes a fire station, the Navy Exchange, the Commissary, a marina, a fuel pier, and a laundromat. In addition, there are several storage/ordinance bunkers (magazines) and large areas of undeveloped, unsewered open space. There are no major industries discharging to the facility. Industrial discharges from the Base to the treatment plant constitute less than 0.4 percent of the design flow.

The wastewater treatment process includes both primary and secondary treatment, as well as disinfection with chlorination. Pollutants typical of a sewage treatment plant treating with chlorine would be expected in the discharge, including five-day carbonaceous biochemical oxygen demand (CBOD5), total suspended solids (TSS), fecal coliform bacteria, total residual chlorine (TRC), pH, ammonia, temperature, phosphorus, and dissolved oxygen (DO). Other pollutants that may occur in the discharge include antimony, arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, fluoranthene, and bis(2-ethylhexyl)phthalate (EPA 2017).

Other potential pollutants, known as emerging chemicals of concern, include pharmaceuticals and personal care products. Personal care products include a wide variety of chemicals commonly used in most households, such as ibuprofen, caffeine, estrogens (natural and synthetic), and DEET (insect repellent). Some of these compounds are eliminated or reduced in concentration by treatment or are sorbed to biosolids and removed from the waste stream; however, some are poorly removed by WWTP processing and may be discharged to surface waters (Meador et al. 2016). Recent studies indicate that younger populations (such as would be expected to occupy the Seaplane Base) use fewer and different types of pharmaceuticals compared to a more typically diverse residential population that includes older residents (Vatovec et al. 2016).

4.1.1 Crescent Harbor Salt Marsh

The WWTP ponds are located within the Crescent Harbor Salt Marsh, which provides important rearing habitat for juvenile Chinook salmon. Inspections conducted by Ecology in 2009 noted that, based on observation, there was reason to believe that the Crescent Harbor Salt Marsh restoration project increased the flooding risk at the Seaplane Base WWTP and likely increased the local groundwater elevation to a point where there was no longer adequate separation from the lagoon liners (Ecology 2011).

Based on monitoring conducted around the perimeter of the WWTP, the groundwater has elevated concentrations of ammonia, high salinity, and a clear tidal influence on groundwater elevations. This suggests the WWTP may be discharging ammonia-laden groundwater into the surrounding salt marsh. However, the monitoring well with the highest concentration of ammonia is located nearest to aerobic lagoons, which are not a significant source of ammonia because these lagoons act to oxidize ammonia to nitrate or nitrite via the process of biological treatment nitrification. The observed monitoring well data may be due to a leak from the anaerobic lagoon (where ammonia concentrations are highest), storm water run-off into the lagoon, or another interaction with natural ammonia producing marsh processes. At present, the exact cause for the elevated concentrations noted in the well data is unknown.

Within a marsh system there may be ammonia oxidizing bacteria that catalyze the oxidation of ammonia (NH_3) to nitrite, and there could be nitrite-oxidizing bacteria, which catalyze the oxidation of nitrite to nitrate (aka “nitrifiers”). The presence of these nitrifying bacteria generally would lower the amount of ammonia naturally found in sediments, but ammonia can also be released from sediments under certain conditions. It is not expected that there would be much background ammonia in the water column from natural sources because nitrogen is typically limiting and is taken up quickly by plants. Therefore, the concentrations of ammonia as measured in groundwater monitoring wells would not necessarily be the same as the ammonia concentrations in the marsh water column.

4.1.2 Climate Change

Climate change is likely to result in sea level rise that will result in flooding of coastal areas and an increase in heavy rainfall events will exacerbate flood risks in many watersheds. There is already an increased frequency of high tides and storm surge that floods the access road to the WWTP and overtops the shoreline berm. In addition, climate change is anticipated to result in lower summer streamflows with higher temperatures and higher winter streamflows (Mauger et al. 2015).

By 2035, sea level increases of 1 foot are estimated to occur at the Seaplane Base (Navy 2016), resulting in a 25 percent or greater chance of flooding of the WWTP on an annual basis with resulting discharges of untreated or partially treated effluent to the marsh (Island County Public Health 2016).

4.2 Limiting Factors and Pathway Matrix Indicators for Salmonids in the Marine Portion of the Action Area

This section describes habitat indicators important for salmon, steelhead, and bull trout in the marine environment. These indicators form the basis for the matrix of pathways and indicators used to establish an environmental baseline for the project and determine the effect of the action. This matrix was originally developed for the purpose of analyzing habitat for Hood Canal Summer Run Chum and Puget Sound Chinook in Hood Canal (Navy 2005), but also has implications for bull trout.

The matrix is adapted here (see Table 4-1 below) for the marine (i.e., Crescent Harbor) portion of the Action Area. The matrix is divided into three categories: water quality, physical habitat parameters, and biological habitat parameters, with habitat indicators falling into one of these three categories. Table 4-1 provides an assessment for each indicator based on habitat quality for salmonids and bull trout: properly functioning, at risk, and not properly functioning, as follows:

- “properly functioning,” means that an element can support healthy populations of fish;
- “at risk,” means that functionality is maintained but there is a likelihood that further degradation would result in a negative response by fish populations; or
- “not properly functioning,” means that there are known limitations to those parameters necessary to support healthy salmonid populations.

This assessment also has implications for other marine species, since salmonids require clean water, cooler temperatures, refugia, and healthy foraging areas, all qualities that benefit other species. In addition, salmon are important prey for other species potentially found in the Action Area, including killer whales.

Table 4-1. Matrix of Pathways and Indicators for the Action Area

Pathways: Indicators	Environmental Baseline		
	Properly Functioning	At Risk	Not Properly Functioning
Water and Sediment Quality			
Turbidity	Low (background below 50 NTU)	Moderate (>5 NTU above background)	High (>10 NTU above background)
		X	
Dissolved Oxygen	>7.0 mg/L	4.0 – 7.0 mg/L	<4.0 mg/L
	X		
Other Water Quality Parameters (temperature, bacteria, pollutants)	No CWA 303d waters; no known pollutant sources present	No CWA 303d waters; known or suspected pollutant sources present	CWA 303d waters present; known pollutant sources present
		X	
Sediment Quality	Sediment quality identified by Ecology as unimpacted	Sediment quality identified by Ecology as impacted	Sediment quality identified by Ecology as toxic
	X		
Physical Habitat			
Substrate/Armoring	Natural conditions, consisting predominantly of mud, sand, and gravel; no armoring	Some armoring of the shoreline with riprap or quay walls	Extensive armoring of the shoreline eliminating sand, mud and gravel areas
		X	
Depth/Slope	Juveniles: shallow, gently sloping nearshore areas (<3 m depth is optimal).	Some bank steepening and loss of shallow water habitat	Steep banks with limited shallow water habitat (primarily > 3 m depth)
		X	
Tideland Condition	Extensive intertidal area exists with limited historical tidal filling	Some filling of tidelands has occurred	Large intertidal areas have been filled; limited remaining tidelands
		X	
Marsh Prevalence and Complexity	Natural conditions; sufficient marsh exists to provide habitat for juvenile salmon	Some loss of marsh habitat has occurred	Marshes absent or inadequate as salmon habitat
		X	

Pathways: Indicators	Environmental Baseline		
	Properly Functioning	At Risk	Not Properly Functioning
Refugia	Habitat refugia exist and are adequately buffered; existing refugia are sufficient in size, number and connectivity to maintain viable populations	Natural refugia exist but are not adequately buffered or are insufficient in size, number, or connectivity	Adequate habitat refugia do not exist
		X	
Physical Barriers	Natural conditions; any man-made barriers allow proper salmon migration	Man-made barriers disrupt salmon migration	Extensive barriers restrict salmon migration
	X		
Biological Habitat			
Benthic Prey Availability	High benthic infaunal abundance and diversity; complex natural community	Alteration in benthic infaunal abundance, diversity, or species composition	Low benthic infaunal abundance and diversity resulting in decreased salmon prey availability
	X		
Forage Fish Community	Natural community consisting of herring, sand lance, surf smelt	Alteration of natural community	Limited abundance and/or diversity decreasing prey availability
		X	
Aquatic Vegetation	Natural conditions	Alteration of natural conditions	Significant alteration
		X	
Exotic Species	No exotic species present	Some exotic species present	Exotic species present - affecting salmon prey and/or predators
		X	

Modified from: U.S. Navy 2005

Key:

CWA = Clean Water Act

mg/L = milligrams per liter

NTU = nephelometric turbidity unit

4.2.1 Water and Sediment Quality

Ecology developed a Marine Water Condition Index (MWCI) to evaluate baseline conditions in Puget Sound (Ecology 2012). The MWCI focuses on changes in nutrients, eutrophication, the oxygen budget, and environmental conditions of the lower trophic level of the pelagic ecosystem. Based on monitoring data from 1999 to 2008, MWCI scores were found to be relatively consistent in Whidbey Basin, indicating relatively stable conditions. In contrast, other portions of the Sound, most notably areas with the highest population density where nutrient discharges have increased, show significantly decreasing MWCI scores (Ecology 2012).

4.2.1.1 Turbidity

Habitat surveys conducted in Crescent Harbor reported substantially higher turbidity conditions than those at West Beach, along the western shore of Whidbey Island (Navy 1997). Although the turbidity was not measured in the 1997 Navy study, it was noted that very little light was able to penetrate beyond 3 meters in depth. For this reason, the turbidity indicator is considered to be “at risk” within the Action Area.

4.2.1.2 Dissolved Oxygen

Data compiled from monitoring conducted during 2007 at Ecology’s short-term monitoring station located in Penn Cove (Station ID: PNN001) indicate a minimum DO level of 6.6 mg/L. The “Excellent” (A) water quality standard for DO for protection of aquatic life in the Action Area is 6.0 mg/L (Ecology 2014). Therefore, the DO indicator is considered to be “properly functioning” within the Crescent Harbor portion of the Action Area. DO is likely compromised within the Crescent Harbor Salt Marsh where tidal circulation is constrained by past alterations.

4.2.1.3 Other Water Quality Parameters

There are no CWA 303(d) impaired waters listed within the Action Area (Ecology 2016).

Discharge from the WWTP outfall is monitored under an NPDES permit and must meet effluent limits for CBOD5, TSS, fecal coliform bacteria, pH, and TRC. The permit also established a limit on Acute Whole Effluent Toxicity (Ecology 2011). Based on discharge monitoring reports from 2011-present, the WWTP has had a good compliance record, with only two incidents of violations of the CBOD5 removal requirement (EPA 2017).

Other nearby point source outfalls near the Action Area include the Penn Cove Wastewater Treatment Plant and the Coupeville Wastewater Treatment Plant, both located approximately 5 miles to the southwest in Penn Cove. Stormwater runoff from Oak Harbor and the Seaplane base along with agricultural runoff from areas east of Oak Harbor can be considered nearby non-point sources of pollutants (Ecology 2011). At the time of turnover of the WWTP to the Navy, the City of Oak Harbor will begin operation of a new WWTP and discharge outfall in Oak Harbor.

The Washington Department of Health and the federal Food and Drug Administration protocol requires shellfish closure zones with a 300-yard minimum radius around WWTP outfalls. Accordingly, all of Oak Harbor and the northwestern quadrant of Crescent Harbor have been closed to commercial geoduck clam harvest since before 1990. The closure zone would need to be re-evaluated if there are modifications to the treatment facility, a new facility, or increases in the flow rate from the WWTP outfall (Carollo Engineers 2011).

For these reasons, the “Other Water Quality Parameters” indicator is considered to be “at risk” within the Action Area.

4.2.1.4 Sediment Quality

Using a sediment quality triad index, Ecology characterized sediment in the Action Area as “unimpacted.” The chemistry index was characterized as “minimum exposure,” the toxicity index was characterized as “non-toxic,” and the benthic index was characterized as “unaffected,” based on sediment sampling conducted in 2007 (Ecology 2007a). Other than the restoration work at the Crescent Harbor Salt Marsh, there has been no other development or change within Crescent Harbor that could be reasonably expected to have affected sediment quality since the testing was conducted.

Ecology reported four Category 1 listings for sediment quality at the location of the WWTP outfall for chromium, copper, lead, and zinc based on samples collected in 2004 (Ecology 2016). Category 1 indicates the samples met standards for all the pollutants for which it was tested.

The sediment quality indicator is considered to be “properly functioning” within the Action Area.

4.2.2 Physical Habitat

4.2.2.1 Substrate/Armoring

Crescent Harbor is primarily a shallow to deep subtidal muddy bay dominated by open, mixed-coarse (sand and cobble) beaches. Open rocky shores occur around Polnell Point. Shallow subtidal rock and boulder habitats occur along the west shore of Crescent Harbor from the finger pier south to Forbes Point (Figure 4-1).

North of the finger pier is a marina that contains docks and boat ramps. Within the immediate vicinity of the pier, the shoreline is comprised of rock riprap, boulders, and concrete rubble. The existing piles in place to support the finger pier alter the nearshore substrate and is, therefore, considered armoring (Navy 2012). Riprap is found along the shore from just south of the finger pier extending north along the docks and ramps and wrapping up along the western edge of the harbor to the point where Torpedo Road swings away from the shoreline. Riprap is also present around the opening in the berm to the salt marsh and again on the eastern edge of the harbor near the neck of Polnell Point. Due to the existence of armoring along many areas of the shoreline, the substrate/armoring indicator in the Action Area is considered to be “at risk.”

4.2.2.2 Depth/Slope

Nearshore habitat in most of Crescent Harbor is gently sloping (Figure 4-1). In the vicinity of the finger pier, minor and infrequent dredging and beach riprap have altered the depth and slope, reducing shallow water habitat in this area. Therefore, the depth/slope indicator for the Action Area is considered to be “at risk.”

4.2.2.3 Tideland Condition

Tidelands along the Crescent Harbor shoreline consist of flat inter-tidal zones that extend out several hundred feet at low tide. There has been some modification of tidelands along the west side of Crescent Harbor by dredging, armoring, and construction of piers, docks, and boat ramps. Therefore, the tideland condition indicator in the Action Area is considered “at risk.”

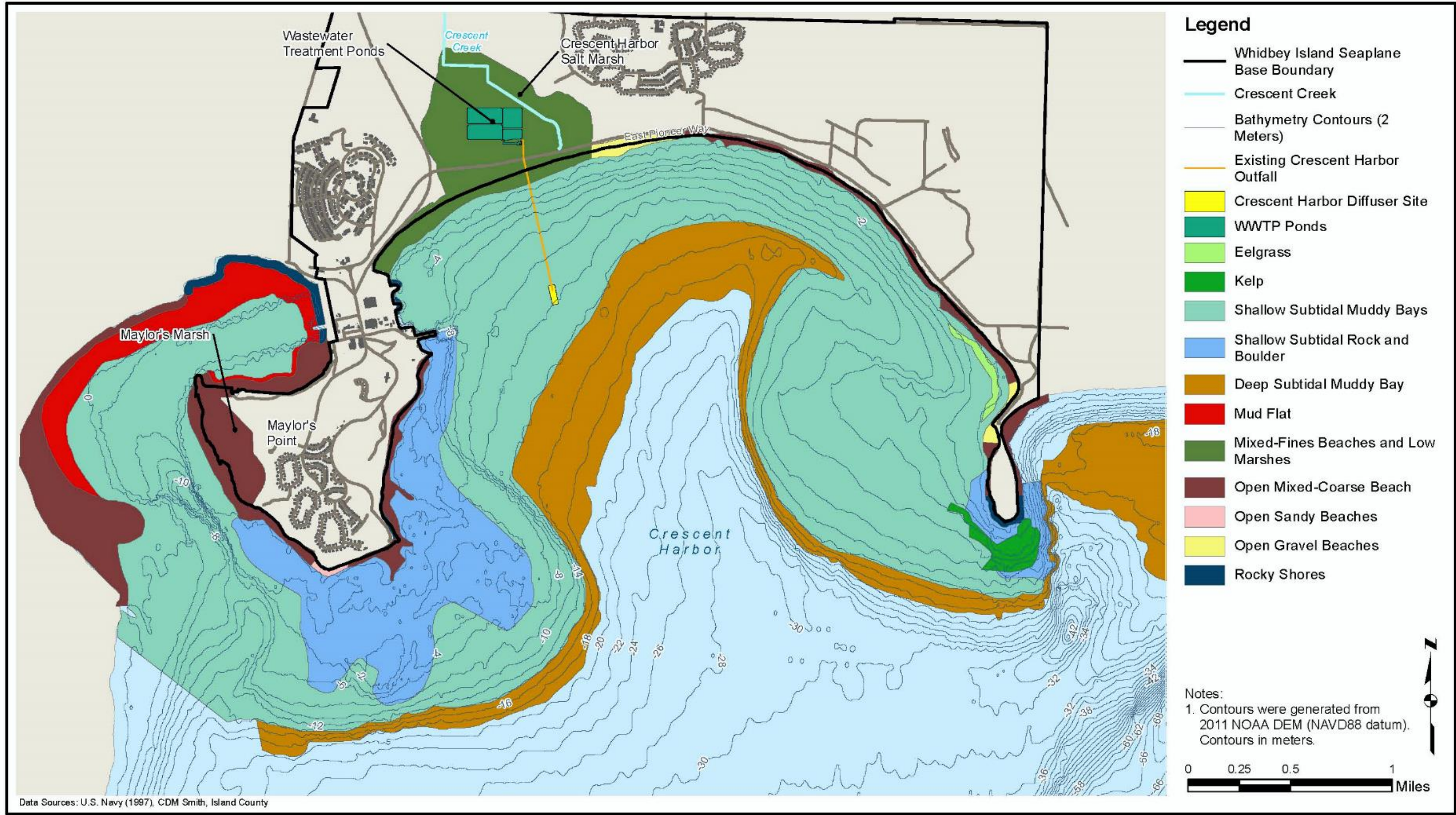


Figure 4-1. Crescent Harbor Substrates

4.2.2.4 Marsh Prevalence and Complexity

As described in Section 3.2.2, Crescent Harbor Marsh and Maylor's Marsh are salt marshes located in and near the Action Area (Figure 1-2). The historical marsh habitat has been modified by diking, draining, and ditching in the past and construction of the WWTP. The Crescent Harbor Salt Marsh restoration project has only partially restored the marsh (Figure 3-1). Therefore, the indicator for marsh prevalence and complexity in the Action Area is considered "at risk."

4.2.2.5 Refugia

Both Crescent Harbor Marsh and Maylor's Marsh provide refugia for juvenile salmon and other aquatic species in and near the Action Area. In addition, aquatic vegetation in Crescent Harbor, including eelgrass and kelp, provides refugia. Aquatic vegetation is described in Section 4.2.3.3. Because refugia habitat has been altered in some areas where structures or armoring have been installed, the refugia indicator in the Action Area is considered "at risk."

4.2.2.6 Physical Barriers

The small number of nearshore structures (e.g., piers) along the Crescent Harbor shoreline do not obstruct salmon migration. Therefore, the physical barriers indicator in the Action Area is considered "properly functioning."

4.2.3 Biological Habitat

4.2.3.1 Benthic Prey Availability

Benthic invertebrate sampling conducted in Crescent Harbor in 2007 indicated the benthic community was "unaffected", with higher than average abundance and taxa richness (Ecology 2007b). Other than the restoration work at the Crescent Harbor Salt Marsh, there has been no other development or change within Crescent Harbor that could be reasonably expected to have affected benthic prey availability since the testing was conducted. Therefore, the benthic prey availability indicator in the Action Area is considered "properly functioning."

4.2.3.2 Forage Fish Community

Adult salmon within Puget Sound feed on common forage fish including Pacific herring (*Clupea harengus pallasii*), surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*). All three forage fish species occur within the Action Area (WDFW 2012). Surf smelt and sand lance spawning sites within the Action Area are shown in Figure 4-2.

It is likely that nearshore structures have altered the amount of forage fish spawning habitat available in the Action Area; although, some documented spawning is occurring in areas with shoreline armoring (Figure 4-2). Therefore, the forage fish indicator is considered "at risk."

4.2.3.3 Aquatic Vegetation

Eelgrass provides important nearshore refugia for juvenile salmon and many other marine species. Eelgrass is present in the Action Area. Frierson et al. (2016) documented eelgrass beds in nearshore areas. The largest occurrence is on the east side of Crescent Harbor, north of Polnell Point, as shown in Figure 4-2 (Navy 2015).

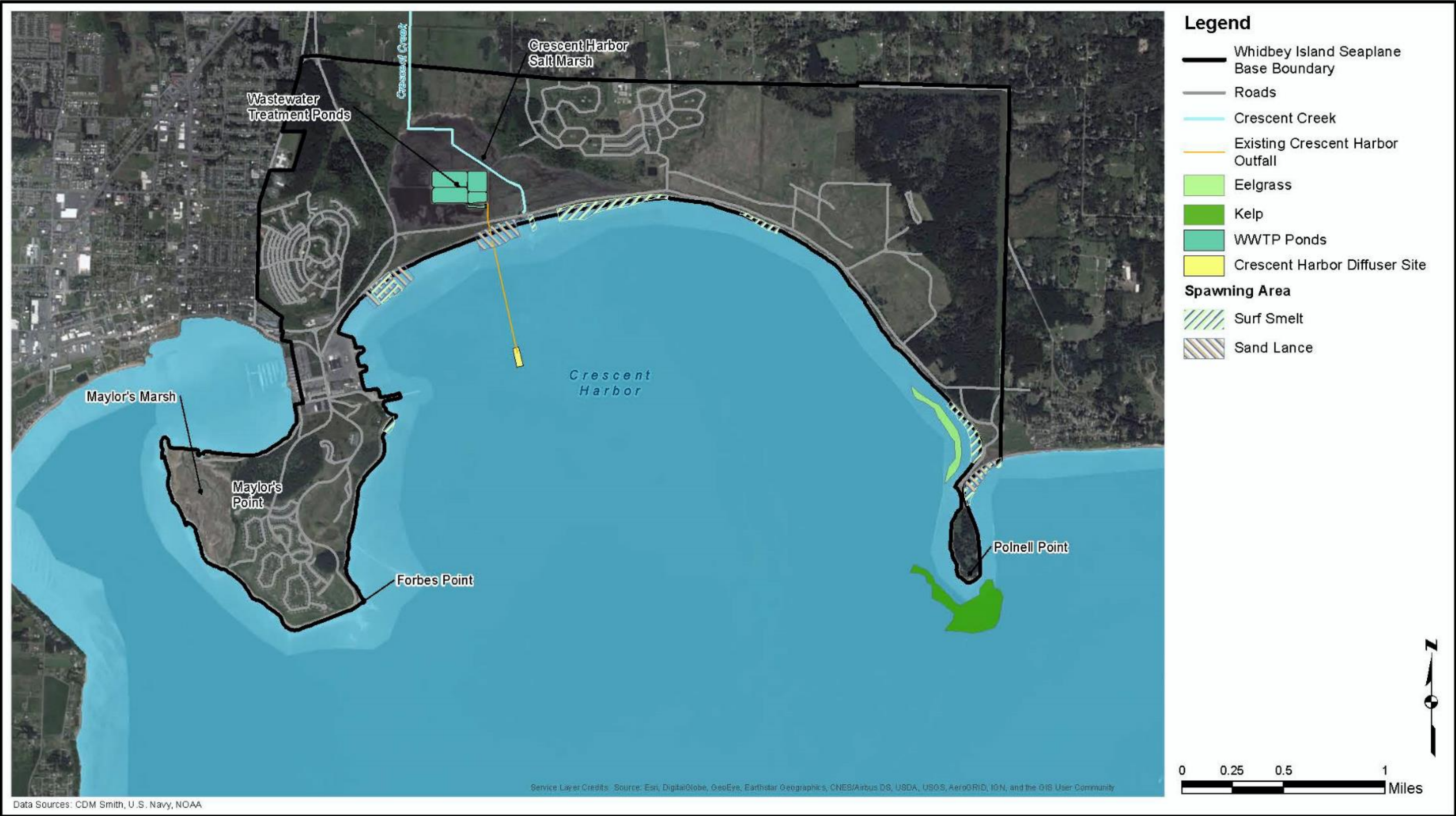


Figure 4-2. Aquatic Vegetation and Forage Fish Spawning

Kelp is typically found on rocky substrates in areas with moderate to high wave energy or currents. It provides important habitat for feeding and refugia for juvenile rockfish. The largest occurrence of kelp also occurs on the east side of Crescent Harbor south of Polnell Point (Figure 4-2) (Navy 2015); although, ESA-listed rockfish have not been found in Crescent Harbor.

During an eelgrass/macroalgae habitat survey for the Navy's breakwater project, small patches of eelgrass and solitary kelp plants were observed near the fuel pier on the west side of Crescent Harbor (Navy 2012). It is likely that eelgrass, kelp, and other aquatic vegetation occurs in small patches or as isolated plants throughout the Crescent Harbor shoreline.

The Navy (1997) suggested that elevated turbidity levels in Crescent Harbor and freshwater inputs from the Skagit River could inhibit the growth of eelgrass. In addition, the mud substrate found in Crescent Harbor is unsuitable for kelp growth.

Some alteration of aquatic vegetation in the Action Area has occurred for shoreline development, including nearshore piers. It can be assumed that, at a minimum, the direct displacement and reduction in light attenuation due to the presence of these overwater structures has reduced the abundance and distribution of nearshore aquatic vegetation in the Action Area. Therefore, the aquatic vegetation indicator is considered "at risk."

4.2.3.4 Exotic Species

The Pacific oyster, an exotic species and one of the most economically important commercial marine species in Puget Sound, occurs throughout Puget Sound waters. Other exotic species may also occur in the Action Area. Although Pacific oysters have not been determined to reduce the suitability of marine habitats for juvenile salmonids, due to its potential presence in the Action Area, the exotic species indicator is considered "at risk."

Green crab have been detected in the San Juan Islands, but not near Whidbey Island.

4.3 Primary Constituent Elements (PCEs)

The shoreline areas of Crescent Harbor and Seaplane Base are excluded from critical habitat designation (70 FR 52630), including the entire Action Area. However, the primary constituent elements (PCE) analysis provides a useful framework for evaluating baseline conditions and potential effects on listed species with designated critical habitat near the Action Area.

4.3.1 Chinook Salmon

PCEs for Chinook salmon near the Action Area include the following:

- Estuarine areas free of obstruction and excessive predation with: (i) water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh water and salt water; (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (iii) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- Nearshore marine areas free of obstruction and excessive predation with: (i) water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting

growth and maturation; and (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

4.3.2 Bull Trout

PCEs for bull trout near the Action Area include the following:

- Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

4.3.3 Juvenile Bocaccio and Yelloweye Rockfish

PCEs for juvenile bocaccio and yelloweye rockfish near the Action Area include the following:

- Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp and with (i) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and (ii) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.
- Nearshore areas are contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters (98 feet) relative to mean lower low water.

4.3.4 Southern Resident Killer Whale

PCEs for southern resident killer whale near the Action Area include the following:

- Water quality to support growth and development.
- Prey species of sufficient quantity, quality, and availability to support individual growth reproduction, and development, as well as overall population growth.
- Passage conditions to allow for migration, resting, and foraging.

Section 5

Effects Analysis

This section presents an analysis of potential effects on listed species from the proposed action. Direct and indirect effects of the proposed action on listed species are discussed in Section 5.1. Direct and indirect effects on applicable critical habitats are addressed in Section 5.2. Interrelated, interdependent, and cumulative effects are discussed in Section 5.3.

5.1 Direct and Indirect Effects

Direct effects are those that occur at, or very close to, the time of the action itself and include immediate effects on a species or its habitat (50 CFR 402.02; USFWS and NMFS [1998]). Indirect effects are those that occur later in time but still are reasonably certain to occur (40 CFR 1508.850; 50 CFR 402.02). A federal action's indirect effects may include the stimulation or inducement of growth or development activities carried out by other persons or entities (National Wildlife Federation v. Coleman, 529 F.2d 359; 5th Cir. Miss. 1976).

5.1.1 Construction of the Outfall Repairs

The proposed action entails repair of the existing WWTP outfall using a "slipline" method. As described in Section 1.4, an HDPE liner would be inserted through the existing outfall pipe including the diffuser. The HDPE pipe would be pulled into the existing outfall pipe via an on-shore pit. Once the new HDPE pipe is in place, divers would construct the diffuser. Potential direct effects on listed species and habitat from in-water work include turbidity and sedimentation, noise and disturbance, and habitat alteration, each of which is discussed below.

No indirect effects are anticipated from construction for the outfall repair. The modified outfall would accommodate lower flows from the WWTP than the existing outfall; therefore, there would be no inducement of growth or development at the Seaplane Base from the proposed action.

5.1.1.1 Turbidity and Sedimentation

Repair of the outfall would result in limited sediment disturbance because the existing outfall pipe will remain in place. Some localized turbidity near the end of the existing pipe may result from flushing accumulated sediment out of the existing outfall pipe. As part of BMPs to be implemented during construction, a silt/turbidity curtain would be used to confine turbidity within the immediate work area when constructing the in-water portion of the outfall (see Section 1.5.1). Sedimentation from on-shore construction disturbance would be prevented with the use of erosion control devices (e.g., silt fencing, straw waddles, etc.) to prevent soil from entering Crescent Harbor or other surface waters (see Section 1.5.1).

Therefore, turbidity and sedimentation effects would be minimal, localized, and limited to the short duration (one month or less) of outfall construction.

5.1.1.2 Noise and Disturbance

There would be noise and disturbance during the outfall repair. Noise would be associated with heavy equipment used to excavate the on-shore pit, generators, winches, and other equipment

needed to push the 14-inch HDPE liner inside the existing 18-inch outfall pipe. In-water noise could be generated by friction of the HDPE as it is pushed or pulled through the outfall pipe. There would also be noise during construction of the diffuser from boat or barge engines, divers, and the sound of moving materials into place. There would be no in-water pile driving, blasting, or other highly intensive noise required.

Noise from the outfall repair would likely cause fish, aquatic birds, and mammals to move away from the immediate vicinity of the outfall. Disturbance from the presence of humans and construction activities would also cause wildlife to move away from the disturbance during work hours.

Construction related noise is anticipated to have an insignificant effect on listed fish species since fish present near the work area would be able to move away from the low intensity, localized noise.

Marbled murrelets, if they were to occur in the project area, would likely be foraging in Crescent Harbor. There is no nesting habitat for marbled murrelets in the project vicinity. Foraging birds in the project vicinity would likely avoid the Action Area during construction activities, moving to suitable foraging habitat away from the disturbance. Marbled murrelets have been documented in Crescent Harbor foraging during the breeding season, which extends from early May to early August. The proposed construction would be limited to August 1 to October 15; therefore, the potential to disturb foraging birds during the breeding season would be minimized.

The project will not result in injury or mortality of marbled murrelets foraging in the Action Area; therefore, the effects of construction noise and disturbance on marbled murrelets are considered insignificant.

5.1.1.3 Habitat Alteration

There would be no alteration of in-water habitat from the proposed action. The existing outfall pipe would remain in place and there would be no alteration of the substrate, slope, aquatic vegetation, or other habitat features. Potential effects on water quality from the effluent discharge are discussed in section 5.1.3 below. There is potential for spills of construction-related hazardous materials (e.g., fuel, oil and hydraulic fluid) that would degrade water quality and/or be toxic to fish, marine mammals, and birds. Heavy equipment associated with the outfall repair would be confined to on-shore areas and BMPs would be implemented to prevent the release of hazardous materials into surface waters, as described in Section 1.5.1. Therefore, the potential for direct effects on listed species or their critical habitat from spills of hazardous materials is considered insignificant.

5.1.2 Construction of the WWTP Improvements

As described in Section 1.4, modifications and improvements to the WWTP processes would be conducted by the Navy over the course of several months following turnover to the Navy. These activities would occur within the perimeter of the existing plant in disturbed areas that do not provide habitat for listed species. Lagoon decommissioning would be the most intensive of these WWTP improvements and would entail the transport of hundreds of truckloads of material in and out of the WWTP on existing roads. Heavy equipment would be confined to staging and access areas within the WWTP boundaries and BMPs would be implemented to prevent the release of hazardous materials into adjacent surface waters, as described in Section 1.5.1. Material removed from the

WWTP would be disposed of in approved locations. Therefore, the potential for direct effects on listed species or their critical habitat from construction of WWTP improvements is considered insignificant.

5.1.3 Effluent Discharge

Possible adverse effects associated with the effluent discharge are related to water quality effects in the Action Area and the likelihood that aquatic organisms will be exposed based on their presence in the Action Area. Exposure of an organism to a contaminant is a function of exposure duration, exposure concentration, bioaccumulation potential of contaminants in exposure media, and depuration rate (elimination of the contaminant from the organism). Exposure depends on life history and life stage. For example, resident fish would be more exposed than migratory fish. In addition, early life stages of fish are typically more sensitive to toxic contaminants than adults. Exposures can be direct or indirect, and the following sections discuss each of these major exposure scenarios.

5.1.3.1 Exposure Analysis

Direct Exposure

Table 5-1 presents the listed species and their life stages with potential to occur in the Action Area and be exposed to the effluent discharge. For most of the species in Table 5-1, there is potential for adults to be exposed to the effluent discharge during migration and/or foraging. Some of these species, including green sturgeon, eulachon, and humpback whale, occur only rarely in the Action Area and exposure would be unlikely or very limited in frequency and duration. In addition, adults of all species are less likely to spend extended amounts of time in one location than juveniles.

Juvenile Chinook salmon and rockfish may occur in nearshore habitats of the Action Area. Rockfish are more likely to be found associated with eelgrass and kelp beds located along the eastern shore of Crescent Harbor (see Figure 4-2). Although juvenile Chinook salmon could occur in the vicinity of the outfall, the outfall diffuser is at a depth of 41 feet and 3,284 feet from shore. Juvenile Chinook salmon are more typically found in nearshore, shallow water areas. Under current conditions, about 25 percent of effluent flow is discharged from a leak in the pipe at approximately 990 feet from the shoreline and a depth of about -15 feet MLLW. Juvenile Chinook may utilize this area if there is sufficient food and aquatic vegetation or cover. With increasing size, juvenile Chinook salmon move into deeper, more offshore habitats and would spend less time in a limited area (Fresh 2006).

Within the Action Area, the Crescent Harbor Salt Marsh is a critical remnant of estuarine habitat that supports the larger Skagit River system for rearing of juvenile salmonids. The number of juvenile Chinook salmon in the vicinity of Crescent Harbor each year is a function of how many fish outmigrate from the nearby Chinook salmon-bearing rivers and/or river flow patterns that trigger migration of Chinook fry into the nearshore (Beamer et al. 2016). Over a five-year monitoring period, Beamer et al. (2016) found the cumulative density of wild juvenile Chinook salmon inside the Crescent Harbor Salt Marsh to be on average 4.6 times higher than in adjacent nearshore habitat in Crescent Harbor, consistent with other studies of Skagit Bay pocket estuaries. Therefore, a significant portion of the juvenile Chinook salmon in the Action Area would be rearing within the Salt Marsh or Crescent Creek during some portion of their early life stage.

Therefore, juvenile salmonids would be more likely to be found within the marsh area during the sensitive juvenile life stage than in Crescent Harbor near the outfall pipe end and diffuser or within the mixing zone for the outfall pipe. Typical habitat use patterns, which would tend to concentrate juveniles closer to the shoreline in shallow water, would also tend to minimize their exposure to direct water quality effects within the mixing zone around the end of the outfall pipe.

Indirect Exposure

Exposure to contaminants in the effluent discharge may also occur indirectly through consumption of contaminated prey (i.e., the dietary exposure pathway). Many of the listed species, including juvenile salmonids, consume benthic invertebrates and smaller fish. Adult salmonids and some higher trophic level mammals such as killer whales consume larger prey (primarily fish) that may have accumulated contaminants in their tissue. Such bioaccumulation is a primary concern for contaminants with high bioconcentration or biomagnification potential, such as mercury, cadmium, polychlorinated biphenyls (PCBs), and some pesticides/herbicides.

Effluent from the existing WWTP has been tested for mercury and cadmium, as described in Section 2.2.4. Cadmium was not detected. The reasonable potential analysis found that there is no reasonable potential to exceed water quality criteria for mercury. There are no major industries discharging to the WWTP and industrial discharges from the Seaplane base to the WWTP constitute less than 0.4 percent of the design flow. The industrial wastewater discharge permit for the Seaplane Base indicates that neither PCBs nor pesticides/herbicides are used at the Seaplane Base and would not be present in wastewater.

The proposed action would eliminate effluent from the City of Oak Harbor where there is a higher proportion of industrial and institutional sources. The proposed action would result in a reduction of the potential for contaminants to be present as compared to the existing condition.

In addition, exposure of benthic invertebrates and bottom dwelling fish to contaminants is expected to be minimal because the effluent discharge is buoyant and would rise and disperse in the water column. Exposure to effluent discharge would be greater for water column invertebrates and pelagic fish. Water column invertebrates are unlikely to comprise a major source of prey for most fish, and therefore, exposure to contaminated invertebrates (benthic and water column) via the dietary pathway is considered insignificant. Bioaccumulation of contaminants by larger, more mobile prey (e.g., pelagic fish) is also expected to be minimal due to the limited exposure frequency and duration and limited detections of bioaccumulative contaminants in the effluent discharge.

Table 5-1. ESA Listed Species and Life Stages with Potential Exposure to the Effluent Discharge

Evolutionarily Significant Unit or Distinct Population Segment/ Scientific Name	Presence in Action Area	Life Stage
Puget Sound Chinook Salmon ESU/ <i>Oncorhynchus tshawytscha</i>	Migration and foraging	Adults and juveniles
Puget Sound Steelhead DPS/ <i>O. mykiss</i>	Migration and foraging	Adults
Coastal-Puget Sound Bull Trout DPS/ <i>Salvelinus confluentus</i>	Migration and foraging	Adults

Evolutionarily Significant Unit or Distinct Population Segment/ <i>Scientific Name</i>	Presence in Action Area	Life Stage
Puget Sound/Georgia Basin Bocaccio Rockfish DPS <i>Sebastes paucispinis</i>	Migration and foraging	Juveniles
Puget Sound/Georgia Basin Yelloweye Rockfish DPS <i>Sebastes ruberrimus</i>	Migration and foraging	Juveniles
Southern DPS of N. American Green Sturgeon <i>Acipenser medirostris</i>	Rare: Migration and foraging	Adults
Southern DPS of Pacific Eulachon <i>Thaleichthys pacificus</i>	Rare: Migration and foraging	Adults
Marbled Murrelet <i>Brachyramphus marmoratus</i>	Foraging	Adults
Southern Resident DPS of Killer Whale <i>Orcinus orca</i>	Migration	Adults
North Pacific Humpback Whale <i>Megaptera novaeangliae</i>	Rare: Migration	Adults

5.1.3.2 Water Quality Analysis

Exposure to the effluent discharge could cause or contribute to adverse effects due to deviations from water quality standards for conventional water quality parameters such as temperature, pH, suspended solids, and dissolved oxygen. In addition, listed species could be exposed to acutely or chronically toxic concentrations of constituents in the discharge, depending on effluent quality and exposure potential. Possible exposure routes could include ingestion and absorption. Potential indirect effects that may be associated with effluent exposure include toxicity to higher tropic levels of the food chain (i.e., killer whale preying on contaminated salmon or marbled murrelet preying on contaminated forage fish) via dietary exposures.

In accordance with an NPDES permit, the discharge from the WWTP outfall must meet effluent limits for CBOD5, TSS, fecal coliform bacteria, pH, total residual chlorine, and Acute Whole Effluent Toxicity (WET) (Ecology 2011). Table 5-2 presents the proposed NPDES permit limits at Turnover. These limits are more stringent than those required by the existing permit with an expected effluent TSS limit of 45 mg/L average monthly and 60 mg/L average weekly (Appendix D of the sewer plan). As can be seen in Table 5-2, potentially toxic constituents that may be in the effluent are addressed using toxicity testing (WET) where test organisms are exposed to serial dilutions of effluent. This approach does not identify individual toxic chemicals in the effluent but instead evaluates the cumulative toxicity of the effluent to standard, representative test organisms. The critical compliance goal as shown below in Table 5-2 is no acute toxicity at 1.2 percent effluent (i.e., no acute toxicity is allowed when effluent concentration is 1.2 percent of the test water).

Table 1-2 Proposed NPDES Limits for Seaplane Base Lagoon WWTP Post Turnover^{1,2,3}

Parameter	Average Monthly	Average Weekly
Carbonaceous Biochemical Oxygen Demand (5-day) (CBOD5)	25 milligrams per liter (mg/L) 119 parts per day (ppd) 85% removal of influent CBOD5 (minimum)	40 mg/L 190 pounds per day (lbs/day)
Total Suspended Solids (TSS)	45 mg/L 214 ppd 65% removal of influent TSS (minimum)	65 mg/L 309 lbs/day
Total Residual Chlorine	0.5 mg/L	0.75 mg/L
Parameter	Daily Minimum	Daily Maximum
pH 9.0 standard units	6.0 standard units	9.0 standard units
Parameter	Monthly Geometric Mean	7-day Geometric Mean
Fecal Coliform Bacteria	200/100 milliliter (mL)	400/100 mL
Acute Toxicity		
No acute toxicity detected in a test concentration equal to the acute critical effluent concentration (ACEC). The ACEC means the maximum concentration of effluent during critical conditions at the boundary of the acute mixing zone. The ACEC equals 1.2 % effluent.		
Table Notes: <ol style="list-style-type: none"> Proposed limits for first permitting period (e.g., 2018-2023) after control of operations are returned to the Navy and prior to implementation of capital improvements by the Navy. Listed effluent concentrations for CBOD5, TSS, pH, and fecal coliform limits, and the percent removal criteria here are consistent with the NPDES permit #WA0026760 "Draft Permit – Not for Comment" document provided by EPA to the Government on July 13, 2017. Effluent loading (ppd) values adjusted for stated concentrations in proportion to the reduced plant effluent flow. 		

Conventional Parameters

Conventional water quality parameters include temperature, pH, and dissolved oxygen (DO), each of which has potential to cause a variety of effects to aquatic organisms.

Temperature

Water temperature affects the distribution, health, and survival of native salmonids and other aquatic organisms by influencing their physiology and behavior. Temperature-dependent life stages for salmonids include spawning, egg incubation, emergence, rearing, smoltification, migration, and pre-spawn holding. Small increases in temperatures (e.g., 2-3 degrees C) above biologically optimal ranges can begin to reduce salmonid fitness in some of these life stages (EPA 2001).

Based on a variety of laboratory studies, temperatures required by anadromous salmon for common summer habitat use ranges from 10-17 degrees C; temperatures for optimal growth range from 10-19 degrees C depending on food availability, and adult migration is blocked at temperatures greater than 21 degrees C (EPA 2001). Applicable state water quality criteria for temperature (WAC 173.201A.210(1)(c)) include an aquatic life temperature criteria of 16 degrees C (highest 1-day maximum) for marine waters classified as “excellent” (Class A).

As described in Section 2.2.3, the mixing zone analysis indicates the temperature at the chronic mixing zone boundary would be 13 degrees C, which is below the aquatic life temperature criterion and below the maximum allowable at the mixing zone boundary to still meet the aquatic life criterion. Therefore, temperature-related effects due to effluent exposure on fish migration or fish populations are not expected. Any unanticipated temperature-related effects would be limited to a small area and would be insignificant in terms of fish survival, reproduction, and growth. Marine mammals and marbled murrelets would be able to easily avoid the plume. In summary, the temperature of the effluent discharge is not likely to adversely affect listed species in the Action Area.

pH

The primary concern with changes in pH for fish in the marine environment is that pH changes can substantially affect the chemical forms and toxicity of other substances. For example, the acute toxicity of ammonia has been shown to increase as pH decreases. In addition, pH affects the solubility, bioavailability, and toxicity of several metals in the water column and in sediments, thereby influencing the exposure of metals to aquatic species. The range of pH suitable for salmonids is 5.5 to 9.0, with an optimal range of 6.8 to 8.0 (USFWS 1986).

State water quality criteria for excellent quality marine waters (WAC 173.201A) specify a pH range of 7.0 to 8.5 standard units with a human-caused variation within the above range of less than 0.5 units. The effluent discharge will meet limitations for pH at the mixing zone boundary. This is based on dilution calculations using recent effluent quality data indicating a maximum pH of 7.8, which is within the range of the ambient pH in the Action Area. Monitoring data from 2005 to 2010 indicate the average pH has ranged from 7.09 to 7.80. The pH effects of the effluent, if any, will be limited in area so as to be insignificant in terms of fish survival, reproduction, and growth as the pH does not vary substantially from the ambient pH. Therefore, the pH of the discharge is not likely to adversely affect listed species in the Action Area.

Dissolved Oxygen (DO)

Reduced dissolved oxygen levels have been shown to cause lethal and sublethal effects (physiological and behavioral) in a variety of organisms, especially fish. As oxygen availability is reduced in the aquatic environment, fish respond by attempting to maintain oxygen uptake by modifying their behavior, including avoidance, reduced feeding, and reduced swimming capacity. Under simulated estuarine conditions, juvenile Chinook salmon avoided DO levels less than 7 mg/L (Birtwell 1989). Juvenile chinook winter mortalities have been reported at DO levels between 2 and 3 mg/L, while juveniles survived at levels ranging from 3 to 7 mg/L. Optimal DO levels for juvenile Chinook are around 9 mg/l at 10 degrees C and 13 mg/L at >10 degrees C (USFWS 1986).

Five-day carbonaceous biochemical oxygen demand (CBOD5) is a measure of the quantity of organic material present in an effluent that is utilized by bacteria. CBOD5 is used in modeling to

estimate the reduction of DO in receiving waters after effluent is discharged. Recent effluent quality data indicate a maximum CBOD5 level of 36 mg/L and an average of 16.3 mg/L. Based on the large amount of dilution in the receiving water at critical conditions, technology based effluent limits for CBOD are sufficient to ensure that water quality criteria for dissolved oxygen are met at the edge of the chronic mixing zone. Therefore, adverse effects to listed fish and mammalian species from CBOD5 in the effluent discharge would be insignificant.

Total Suspended Solids (TSS)

Movement of TSS into streams and estuaries is a natural process occurring primarily through surface and stream bank erosion. Ephemeral high concentrations of suspended sediments that occur during storms and snowmelt runoff may have short term effects on biota such as behavior responses (e.g. avoidance). Prolonged exposure to high concentrations of suspended solids may harm fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging gills and respiratory passages. Suspended solids can inhibit light transmission, reduce aquatic vegetation, and contribute to oxygen depletion. Settling of suspended sediment can alter substrate and reduce suitable habitat for some benthic organisms.

There is a wide diversity of response to specific concentrations of TSS, ranging from avoidance, reduced feeding rate or feeding success, physiological stress, reduced growth rate, and mortality. Vulnerability to TSS effects varies with life history phase. Juvenile and larval salmonids are more susceptible to TSS than adults. Various studies have indicated that high concentrations of suspended sediment impair salmonid foraging (Bisson and Bilby 1982; Berg and Northcote 1985). At concentrations between 2,000 and 3,000 mg/L, exposed yearling coho and steelhead did not rise to the surface to feed (Redding et al. 1987). However, yearling coho and steelhead exposed to lower levels ranging from 400 to 600 mg/L actively fed at the surface. Servizi and Martens (1992) found a threshold for the onset of avoidance at 300 mg/l TSS.

Within the Action Area, juvenile salmonids are the most vulnerable life stage of the listed species that may be exposed within the mixing zone. Past monitoring data from 2005 to 2010 show a monthly average TSS of 24.9 mg/L with a maximum value of 42 mg/L. The average monthly TSS concentration limit of 45 mg/L under the proposed NPDES permit would be protective of juvenile salmonids (Newcombe and Jensen 1996).

The TSS effluent limits for the new NPDES permit for Navy-only operation are expected to be more stringent than the previous permit. Process improvements to meet these limits, as described in Section 1.4, include improvements to the settling tanks and dechlorination system and hydraulic improvements. With these improvements, effluent limits will be met and TSS in the discharge is not expected to pose meaningful risk to aquatic life, including threatened salmonids and benthic organisms in the Action Area.

Bacteria

Fecal coliform bacteria are found in the feces of warm-blooded animals and can indicate the presence of other disease-carrying organisms (pathogens). Effluent limits set maximum levels of fecal coliform bacteria allowable to protect the designated uses of the receiving water, including recreation and shellfish harvest. Although fecal coliform data for surface water are not directly applicable to wildlife, it is assumed that fecal coliform bacteria in water at levels below effluent

limits for protection of designed uses are protective of listed avian and mammalian species in the Action Area.

Nutrients

Excess nutrients (nitrogen and phosphorus) can artificially stimulate plant growth, resulting in algal blooms. When algae die, their decomposition contributes to low dissolved oxygen levels in surface water. Juvenile salmonids are particularly susceptible to low dissolved oxygen. Low dissolved oxygen levels can impair the respiration of fishes and other aquatic organisms resulting in both behavioral and physiological responses, including death. Nutrient loading in Puget Sound and resulting low dissolved oxygen levels are a primary threat to salmonid populations (NMFS 2007b). Excess nutrients are regulated through limits on CBOD5.

Based on past performance over the last five years the WWTP provides significant biological treatment of wastewater. Over the last four years the Seaplane Base achieved a 30-day average of at least 65 percent of CBOD5. In fact, the facility achieved a minimum removal of 94 percent during the last four years. With the lower volume under Navy-only flows, nutrient levels in the effluent discharge would not adversely affect listed species or other aquatic organisms.

Whole Effluent Toxicity (WET)

Whole Effluent Toxicity (WET) refers to the aggregate toxic effect on aquatic organisms from all pollutants in an effluent. WET testing entails laboratory tests to measure toxicity directly by exposing standard test species representative of resident organisms to the effluent and measuring their responses (e.g., ability to survive, grow and reproduce). The proposed permit retains the acute toxicity limit which requires WET testing using fathead minnow (*Pimephales promelas*) and *Ceriodaphnia dubia*, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. WET tests would be done on a schedule in compliance with the final NPDES permit. Compliance with WET criteria is another indicator or line of evidence that the effluent discharge would not adversely affect listed species or other aquatic life in receiving waters.

Acute and Chronic Toxicity

As described in Section 2.2, the acute and chronic mixing zones for the Seaplane Base WWTP outfall diffuser is a horizontal distance of 24.1 and 241 feet, respectively, from all ports. Acute and chronic water quality standards must be achieved at these boundaries.

It is important to note that the existing leak in the outfall pipe located approximately 990 feet from the shoreline at about -15 feet MLLW may continue into the five-year permit cycle covered by this BA. While only 25 percent or less of the flow may be released at this leak, it represents an additional area where water quality criteria and a mixing zone would be applied.

Ammonia

Ammonia is toxic to fish and other aquatic life, with the most toxic form of ammonia being the unionized form (NH_3). Fish exposed to ammonia may experience a range of effects, including loss of equilibrium, hyperexcitability, increased breathing, cardiac output, and oxygen uptake, and, in very high concentrations, convulsions, coma, and death. At lower concentrations, ammonia may have adverse effects on fish, such as reduction in hatching success, reduction in growth rate and morphological development, and pathologic changes in tissues of gills, livers, and kidneys (EPA

1999). Factors that have been shown to affect ammonia toxicity in water include dissolved oxygen concentration, temperature, pH, previous acclimation to ammonia, fluctuating or intermittent exposures, carbon dioxide concentration, salinity, and the presence of other toxicants (EPA 1999).

During ammonia exposure, estuarine fish are likely to be most at risk when they are larvae or juveniles, if the temperature is elevated, if salinity is near the sea water value and if the pH value decreases below pH 7. They are also likely to be at risk in waters of low salinity, high pH and high ammonia levels. These conditions favor transfer of ammonia from the environment into the fish, as both ionized and unionized ammonia, and retention of ammonia by the fish is likely. Since ammonia interferes with nervous function there may be impairment of activity and behavior. Fish will be further at risk from ammonia toxicity if they are not feeding, if they are stressed, and if they are active and swimming.

Most fish species are adept at sensing and avoiding very low concentrations of ammonia, and can be exposed to acutely toxic concentrations of ammonia without suffering any obvious long-term effects, as long as these exposures are short (Thurston et al. 1981). Studies conducted by Thurston et al. (1984) found low levels of adverse effects at NH_3 concentrations ranging from 0.01 to 0.07 mg/L over a period of 5 years. Pathological lesions in the gills and extensive tissue degradation in the kidneys were directly correlated with ammonia concentrations above 0.04 mg/L after 4 months of exposure. In another study, sockeye salmon eggs exhibited reduced hatchability at 0.12 mg/L NH_3 (Rankin 1979).

Acute and chronic state water quality criteria (WAC 173.201A.240, Table 240, Toxics Substances Criteria) for ammonia (as NH_3) in marine water are 0.233 mg/L and 0.035 mg/L, respectively. Ammonia criteria are based on a formula which relies on the pH and temperature of the receiving water, because the fraction of ammonia present as the toxic, unionized form increases with increasing pH and temperature. Therefore, the criteria become more stringent as pH and temperature increase. The criteria were based on the 95th percentile of pH (7.8) and temperature (21 degrees C) of the effluent data.

Acute and chronic water quality criteria for NH_3 in the Action Area were calculated using the NH_3 -marine tab in Ecology's PermitCalc spreadsheet as 12 mg/L and 1.8 mg/L, respectively. Maximum ammonia concentrations were estimated at 0.359 mg/L and 0.204 mg/L at the acute and chronic mixing zone boundaries for the permitted plant flow, respectively. For the initial condition at Turnover, with 2018 flows and unrepaired outfall, maximum ammonia concentrations were estimated at 0.928 mg/L and 0.295 mg/L at the acute and chronic mixing zone boundaries, respectively. Based on the RPA, there is no reasonable potential for the effluent to exceed surface water quality standards for ammonia with the outfall repaired or under the existing condition, as shown in Table 2-2 and Table 2-3, respectively. Juvenile salmon in the Action Area could sense and avoid areas with the low concentrations of ammonia estimated within the mixing zone, moving to adjacent areas of suitable habitat outside the mixing zone. Therefore, ammonia in the effluent discharge is not likely to adversely affect aquatic species in the Action Area, including listed species.

Chlorine

Acute toxicity studies of chlorine using salmonids have reported a lethal concentration 50 (LC_{50}) for juvenile pink salmon of 50 $\mu\text{g/L}$ and a LC_{100} of 100 $\mu\text{g/L}$ for juvenile Chinook salmon (Holland et al.

1960). The chronic toxicity level was a LC_{50} of 80 µg/L for coho salmon (Holland et al. 1960). State water quality standards (WAC 173.201A.240, Table 240, Toxics Substances Criteria) for marine water for total residual chlorine are 13 µg/L as a 1-hour average and 7.5 µg/L as a 4-day average. Therefore, water quality standards are protective of juvenile salmonids.

Maximum chlorine concentrations in the effluent were estimated at 2.8 µg/L and 1.2 µg/L at the acute and chronic mixing zone boundaries for the permitted plant flow, respectively. For the initial condition at Turnover, with 2018 flows and unrepaired outfall, maximum chlorine concentrations were estimated at 8.6 µg/L and 2.1 µg/L at the acute and chronic mixing zone boundaries, respectively. Based on the RPA, there is no reasonable potential for the facility to exceed surface water quality standards for chlorine both with the outfall repaired and under the existing condition, as shown in Table 2-2 and Table 2-3, respectively. As stated above, these water quality standards are protective of juvenile salmonids. Therefore, chlorine in the effluent discharge is not likely to adversely affect aquatic species in the Action Area, including listed species.

Metals

Metals are persistent contaminants in treated wastewater, bound to sediment or particulates suspended in water, or present in the dissolved phase. As persistent chemicals, metals can accumulate in surface sediments or, in some cases, can accumulate in the tissues of aquatic life (bioaccumulate). Some metals are essential for life (e.g., copper and zinc) and concentrations in biota are regulated.

Discharge of metals at sufficiently high concentrations and in toxic forms could result in a variety of effects on listed species and habitats. These effects can range from lethal to sublethal effects, which include reduced growth, fecundity, avoidance, reduced stamina, and neurophysiological and histological effects on the olfactory system. Reduced olfactory function in salmonids can increase the vulnerability of affected individuals to predators, reduce feeding efficiency, and reduce the likelihood of successful migration (Baldwin et al. 2003).

For juvenile salmon living in freshwater, exposures to dissolved copper concentrations as low as 5 µg/L have been shown to be toxic to the olfactory system (Baldwin 2003). However, as juveniles migrate into estuaries and encounter increased salinities, they appear to tolerate concentrations of dissolved copper at 50 µg/L without exhibiting significant olfactory toxicity (Baldwin 2012). The study concluded that copper-induced inhibition of the olfactory system of seawater-phase Chinook salmon requires an exposure concentration of greater than 100 µg copper/L. Baldwin has postulated that the large difference in copper olfactory toxicity in freshwater- versus seawater-phase salmon may be the result of water salinity (e.g., the high concentration of various cations and anions in seawater serving to mask copper cations from the olfactory tissue) or salmon physiology (e.g., changes upon smoltification in the proteins involved in olfaction that reduce their sensitivity to dissolved copper) (Baldwin 2012). Because the outfall is located in marine waters and juveniles that would encounter the effluent will have undergone smoltification, the higher limits would be used to evaluate potential effects.

As described in Section 2.2.4, the RPA used the maximum concentrations from three priority pollutant scans performed on the existing effluent in May 2015, August 2015, and October 2015, which includes the effluent from the City as well as the Seaplane Base. The maximum concentrations of metals in the effluent at the acute and chronic mixing zone boundaries are shown

in Table 2-2 (outfall repaired) and Table 2-3 (existing condition). Based on the RPA, there is no reasonable potential for the facility to exceed surface water quality standards for metals with the outfall repaired or under the existing condition.

The maximum concentrations of copper and zinc used in the RPA (14 ug/L and 28 ug/L, respectively), would be unlikely to have measurable adverse effects on listed fish species if the species are present within the mixing zone. As discussed in Section 5.1.3.1, due to the relatively small size of the mixing zone, its distance off shore, and the depth of the mixing zone, the duration of any exposure is expected to be short and only a few individuals would be exposed. In addition, the Navy-only flows would eliminate most of the industrial/commercial sources found in the existing effluent and does not include any stormwater runoff; therefore, the potential for exposure to metals would be negligible.

Unregulated Contaminants

Municipal wastewater contains numerous unregulated contaminants generated from the daily use of products disposed of via the sewer system and industrial process discharges. Wastewater effluent has been implicated as a source of endocrine disrupting chemicals (e.g., plasticizers, fire retardants, and detergent metabolites), pharmaceuticals and personal care products, and other compounds of anthropogenic origin (Meador et al. 2016). Many of these unregulated contaminants occur at extremely low concentrations, making them difficult to consistently and accurately measure. Some of these contaminants, such as polybrominated diphenyl ethers (PBDEs) bioaccumulate in the food chain (EPA 2014).

Meador et al. (2016) reported the presence of many of these chemicals in effluent, estuary water, and fish tissue in Puget Sound and found a high potential for bioaccumulation. These chemicals have a variety of effects in aquatic organisms, including effects on development, growth, and reproduction. In addition, the interactions of mixtures of these contaminants can be additive, synergistic, or inhibitory, which are difficult to assess in the field or laboratory (Meador et al. 2016).

Salmonids in the Action Area may be exposed to individual contaminants and mixtures of contaminants, but the extent to which effects related to unregulated compounds would result in a significant impairment or disruption of behavioral patterns such as feeding, breeding, or sheltering is unknown. As discussed in Section 5.1.3.1, the exposure of salmonids and other listed species to the effluent discharge is limited. In addition, the volume of effluent will decrease significantly with Navy-only flows, and the Navy population is anticipated to use less of these unregulated compounds, as discussed in Section 4.1. Therefore, direct effects from unregulated contaminants are considered insignificant. However, there may be some potential for some contaminants such as PBDEs to bioaccumulate at low levels in fish exposed to these contaminants in the mixing zone.

5.1.4 Effects on Pathways and Indicators

This section presents an evaluation of the potential effects of the proposed action on pathways and indicators of the environmental conditions important for listed fish species in the Action Area.

For each of the indicators in Table 5-3, the proposed action is expected to maintain the baseline condition, meaning that the function of an indicator would not change. For water and sediment

quality, the proposed action would maintain baseline with compliance with applicable water quality criteria and requirements of the proposed NPDES permit. For the physical habitat pathway, the effects of the proposed action are limited to slipline repair of the outfall, which would not change substrate, depth, slope, or other important indicators and would not introduce physical barriers to migration. For the biological habitat pathway, the proposed action would not alter benthic prey availability, forage fish, or aquatic vegetation, and would not result in a change with respect to the presence of exotic species.

Table 5-3. Effects of Proposed Action on Pathways and Indicators

Pathways: Indicators	Environmental Baseline			Effects of the Proposed Action		
	Properly Functioning	At Risk	Not Properly Functioning	Restore to Baseline	Maintain Baseline	Degrade Baseline
Water and Sediment Quality						
Turbidity	Low (background below 50 NTU)	Moderate (>5 NTU above background)	High (>10 NTU above background)		X	
		X				
Dissolved Oxygen	>7.0 mg/L	4.0 – 7.0 mg/L	<4.0 mg/L		X	
	X					
Other Water Quality Parameters (temperature, bacteria, pollutants)	No CWA 303d waters; no known pollutant sources present	No CWA 303d waters; known or suspected pollutant sources present	CWA 303d waters present; known pollutant sources present		X	
		X				
Sediment Quality	Sediment quality identified by Ecology as unimpacted	Sediment quality identified by Ecology as impacted	Sediment quality identified by Ecology as toxic		X	
	X					
Physical Habitat						
Substrate/Armoring	Natural conditions, consisting predominantly of mud, sand, and gravel; no armoring	Some armoring of the shoreline with riprap or quay walls	Extensive armoring of the shoreline eliminating sand, mud and gravel areas		X	
		X				

Pathways: Indicators	Environmental Baseline			Effects of the Proposed Action		
	Properly Functioning	At Risk	Not Properly Functioning	Restore to Baseline	Maintain Baseline	Degrade Baseline
Depth/Slope	Juveniles: shallow, gently sloping nearshore areas (<3 m depth is optimal).	Some bank steepening and loss of shallow water habitat	Steep banks with limited shallow water habitat (primarily > 3 m depth)		X	
		X				
Tideland Condition	Extensive intertidal area exists with limited historical tidal filling	Some filling of tidelands has occurred	Large intertidal areas have been filled; limited remaining tidelands		X	
		X				
Marsh Prevalence and Complexity	Natural conditions; sufficient marsh exists to provide habitat for juvenile salmon	Some loss of marsh habitat has occurred	Marshes absent or inadequate as salmon habitat		X	
		X				
Refugia	Habitat refugia exist and are adequately buffered; existing refugia are sufficient in size, number and connectivity to maintain viable populations	Natural refugia exist but are not adequately buffered or are insufficient in size, number, or connectivity	Adequate habitat refugia do not exist		X	
		X				

Pathways: Indicators	Environmental Baseline			Effects of the Proposed Action		
	Properly Functioning	At Risk	Not Properly Functioning	Restore to Baseline	Maintain Baseline	Degrade Baseline
Physical Barriers	Natural conditions; any man-made barriers allow proper salmon migration	Man-made barriers disrupt salmon migration	Extensive barriers restrict salmon migration		X	
	X					
Biological Habitat						
Benthic Prey Availability	High benthic infaunal abundance and diversity; complex natural community	Alteration in benthic infaunal abundance, diversity, or species composition	Low benthic infaunal abundance and diversity resulting in decreased salmon prey availability		X	
	X					
Forage Fish Community	Natural community consisting of herring, sand lance, surf smelt	Alteration of natural community	Limited abundance and/or diversity decreasing prey availability		X	
		X				
Aquatic Vegetation	Natural conditions	Alteration of natural conditions	Significant alteration		X	
		X				
Exotic Species	No exotic species present	Some exotic species present	Exotic species present affecting salmon prey and/or predators		X	
		X				

Modified from: U.S. Navy 2005

Key:

CWA = Clean Water Act

mg/L = milligrams per liter

NTU = nephelometric turbidity unit

5.1.5 Effects on Crescent Harbor Salt Marsh

Biological treatment lagoons like the ones at the Seaplane Base WWTP are known to have some amount of leakage into the subsurface. An allowable leakage rate (ALR) is usually set by the original designers and/or by the permitting agency at the time of construction to protect groundwater. For the Seaplane Base WWTP, however, no ALR was set when the lagoons were originally designed or constructed. The City of Oak Harbor installed four monitoring wells around the Seaplane Base WWTP in 2008, prior to the completion of the Crescent Harbor Salt Marsh restoration project. Groundwater monitoring around the lagoon facility shows recent (2013-2016) evidence of elevated ammonia concentrations at the perimeter of the WWTP. Therefore, there is a high potential that the ammonia-laden groundwater is discharging into the surrounding Crescent Harbor Salt Marsh.

Although the well showing the highest levels is near a lagoon that would be decommissioned early in the permit (the Northeast lagoon), it is an aerobic lagoon and is not likely a source of ammonia. Therefore, it is not possible to determine whether the observed levels are associated with leakage from the anaerobic lagoon (where ammonia concentrations are highest), stormwater runoff, and/or interactions with natural marsh processes that may also generate ammonia. It is also not known whether the levels observed in the groundwater monitoring wells adjacent to the lagoons represent any change in levels in the water column of the marsh. Nitrogen tends to be limiting and would be quickly taken up by marsh plants.

The proposed NPDES permit includes a compliance schedule that requires the Navy to determine the impact of the treatment plant on the surrounding salt marsh water quality based on two years of groundwater sampling and a groundwater investigation, with consideration of expected fate and transport of contaminants. The due date for this requirement in the draft permit was tentatively set at 2.5 years from Turnover. Groundwater monitoring would continue in compliance with the permit.

Ongoing groundwater monitoring would be used to determine if ammonia or other contaminants are being released from the WWTP lagoons and adversely affecting water quality in the Crescent Harbor Salt Marsh. This may require an analysis of the hydrogeological conditions and mixing/dilution within the marsh to determine the nature and extent of any water quality effects from lagoon leakage. If groundwater monitoring results indicate there is potential for adverse effects on juvenile Chinook salmon rearing in the salt marsh due to lagoon leakage, consultation with NMFS would be reinitiated.

5.2 Analyses of Effects on Critical Habitat Primary Constituent Elements

While the Action Area is excluded from critical habitat designation, PCEs for several species do occur within the Action Area and are important for listed species that may be present. The PCEs also provide a useful framework for evaluating potential effects on listed species within the Action Area. This section presents an analysis of the potential effects of the proposed action on PCEs of critical habitat in the Action Area.

5.2.1 Chinook Salmon Critical Habitat

PCEs for Chinook salmon in the Action Area include estuarine areas (both Crescent Harbor Salt Marsh and Puget Sound), nearshore marine shoreline rearing areas along Crescent Harbor shorelines, and offshore marine areas in Crescent Harbor. Required components of these PCEs include water quality conditions, cover, and forage to support growth and maturation of juveniles and foraging/migrating adults.

Effects on water quality from construction of the outfall repairs would be avoided or minimized with the implementation of the measures presented in Section 1.5. These include physical measures to address potential turbidity and erosion and prevent hazardous materials from being released during construction. In addition, other potential direct effects on listed species would be avoided or minimized as described in Section 1.5 with implementation of timing restrictions to conduct the work when listed species are less likely to be present and monitoring during construction to avoid disturbance.

Effects on water quality from the effluent discharge would be limited to the mixing zone area where exposure of listed species would be minimal. Forage fish, including surf smelt and sand lance, spawn within the Action Area, but would be expected to spend a very limited amount of time within the mixing zone of the effluent discharge. Therefore, forage fish would not be adversely affected so as to reduce forage for Chinook salmon. In addition, given the low level of exposure and concentrations of contaminants, forage fish would not be expected to bioaccumulate contaminants to any significant degree such as to adversely affect Chinook salmon that prey on them.

The proposed action would not impede migration of Chinook salmon. No submerged or overhanging large woody debris, aquatic vegetation, or substrate would be disturbed.

Groundwater monitoring around the WWTP lagoons would be continued to assess potential adverse effects from constituents (e.g., ammonia) leaking into the Crescent Harbor Salt Marsh. If groundwater monitoring results indicate there is potential for adverse effects on juvenile Chinook salmon rearing in the salt marsh due to lagoon leakage, consultation with NMFS would be reinitiated.

5.2.2 Bull Trout Critical Habitat

PCEs for bull trout in the Action Area include migration habitat, abundant food base, and water quality.

As described above, effects on water quality from repair of the outfall would be avoided or minimized with the implementation of BMPs. Water quality effects from the effluent discharge would be limited to the mixing zone area where exposure of bull trout would be minimal. Forage fish would not be adversely affected so as to reduce forage for bull trout. In addition, given the low level of exposure and concentrations of contaminants, forage fish would not be expected to bioaccumulate contaminants to any significant degree such as to adversely affect bull trout that prey on them. The proposed action would not impede migration of bull trout.

5.2.3 Juvenile Bocaccio and Yelloweye Rockfish Critical Habitat

PCEs for juvenile bocaccio and yelloweye rockfish in the Action Area include nearshore habitats including juvenile settlement habitats with suitable substrate and kelp with food and good water quality to support growth, survival, reproduction, and feeding opportunities.

Suitable habitat for rockfish in the Action Area is associated with eelgrass beds and kelp growth in the eastern corner of the Action Area near Polnell Point; although, ESA-listed species have not been observed in Crescent Harbor. As described above, effects on water quality from construction would be avoided or minimized with the implementation of BMPs. Effects on water quality from the effluent discharge would not extend into areas where rockfish would be typically found in the Action Area, and there would be no effects on habitat or forage for rockfish from the proposed action.

5.2.4 Southern Resident Killer Whale Critical Habitat

PCEs for killer whale in the Action Area include water quality, quality and quantity of prey, and passage conditions for migration, resting, and foraging.

As described above, effects on water quality from repair of the outfall would be avoided or minimized with the implementation of BMPs. Water quality effects from the effluent discharge would be limited to the mixing zone area where exposure of killer whales would be minimal. Forage fish would not be adversely affected so as to reduce the quantity of forage for killer whales. Prey for killer whales, including salmonids, would not be expected to bioaccumulate contaminants from the effluent discharge so as to adversely affect killer whales. The proposed action would not impede the passage of killer whales in the Action Area.

5.3 Interrelated, Interdependent, and Cumulative Effects

Interrelated actions are those “that are part of a larger action and depend on the larger action for their justification”, while interdependent actions are defined as those “with no independent utility apart from the proposed action” (50 CFR 402.02).

Cumulative effects include those future state or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area. The impacts of future state or private development are analyzed as cumulative effects if there is no causal relationship between the development and the federal action under consideration (40 CFR 1508.7; 50 CFR 402.02). If a causal relationship exists between a federal action and future private, local, or state development, the development’s environmental impacts should be discussed as an indirect effect of the underlying federal action (40 CFR 1508.8; 50 CFR 402.02; *National Wildlife Federation v. Coleman*; USFWS and NMFS [1998]). Where future private, local, or state development is subject to federal discretion, it is not analyzed as part of an ongoing Section 7 consultation, because it will be addressed in a separate future Section 7 consultation (50 CFR 402.02; USFWS and NMFS [1998]).

No future state or private activities have been identified that would result in cumulative effects within the Action Area. The Action Area is under the control of the Navy and would not be subject to state or private actions.

There are no interrelated or interdependent effects related to the proposed action.

Section 6

Determination of Effects

The determination of potential effects of the proposed action on listed species is based on the analysis presented in Section 5 and considers the following:

- Environmental setting
- Importance of the Action Area to listed species
- The degree of predicted effects of the proposed action with the implementation of proposed avoidance and minimization measures

6.1 Summary of Effects

Direct effects associated with repair of the outfall would be limited due to the limited nature of the repair and the proposed construction methods. Some localized turbidity may result from flushing accumulated sediment out of the end of the existing outfall pipe during the sliplining activities; however, this effect would be short-term and localized and minimized with implementation of avoidance and minimization measures described in Section 1.5. Therefore, effects on listed species associated with water quality effects from in-water construction would be insignificant. Effects of construction noise and disturbance on listed fish species, marbled murrelets, and marine mammals are considered insignificant due to the nature of the construction activities (sliplining the pipe inside the existing pipe and assembling the diffuser), the short duration, limited area of construction, and implementation of measures including timing restrictions and monitoring.

Exposure to pollutants in the discharge would be both a direct effect and indirect effect through the food chain from benthic contamination (and potentially bioaccumulation). These effects would be limited to the mixing zone, and levels of contaminants would be low based on expected compliance with effluent limits of the NPDES permit. In addition, the volume and loading of the discharge will be significantly less than the existing condition.

For listed species with the potential to occur in the Action Area, there is a very low potential for adults to be exposed to contaminants in the effluent discharge. Some of these species, including green sturgeon, eulachon, and humpback whale, occur only rarely in the Action Area and exposure would be unlikely or very limited. Adult Chinook salmon, steelhead, bull trout, yelloweye and bocaccio rockfish, marbled murrelet, and killer whales may enter the mixing zone during migration and/or foraging, but would not be expected to spend extended amounts of time in one location. Therefore, exposure to contaminants in the effluent discharge is expected to be insignificant for adults of all listed species.

Juvenile Chinook salmon and rockfish prefer nearshore areas with aquatic vegetation or cover. The mixing zone that currently exists around the leak in the outfall pipe is at approximately 990 feet from the shoreline and a depth of about -15 feet MLLW. It is estimated that less than 25 percent of effluent flow is discharged in that area, while the remainder of the discharge occurs at 3,284 feet from shore at a depth of -41 feet MLLW. Under the proposed action, this leak would be repaired and

the discharge would all be directed to a new diffuser at the end of the outfall pipe further offshore and in deeper water. In addition, the volume of the discharge would be significantly less.

Juveniles using the nearshore for migration and foraging could be in the mixing zone for a short duration and could be exposed for short periods of time to pollutants (e.g., chlorine, ammonia, and metals) that exceed water quality standards. Juvenile fish could also be exposed to low levels of unregulated contaminants. During this exposure, there is some potential for exposed juvenile salmonids to accumulate these pollutants. However, due to the relatively small size of the mixing zone, the short period of exposure, and the relatively low levels of pollutants discharged, effects to juvenile Chinook salmon and rockfish are expected to be insignificant.

The proposed action is not likely to adversely affect salmonids, as described above. For the same reasons, non-listed fish species would not be adversely affected. Therefore, the proposed action will not affect the quantity of salmonids and other prey available to marbled murrelets, killer whales, or humpback whales.

The proposed action may affect the quality of prey for these species by introducing contaminants into their food chain. Some metals and unregulated contaminants, such as PBDEs, are part of the effluent composition. These contaminants persist in the environment and may bioaccumulate in prey species. For top predators like marbled murrelets, killer whales, and humpback whales, this bioaccumulation of contaminants can affect health and reproductive success. However, with the withdrawal of the City effluent from the discharge, the quantity of these types of contaminants is expected to be reduced as compared to the existing condition.

The Action Area represents a very small part of the foraging habitat for top predator species. It is unlikely that these species would spend a significant portion of time within the Action Area or consume a significant portion of their prey from the Action Area. Furthermore, very few salmonids would be exposed to metals, PBDEs, or other bioaccumulative contaminants in the small mixing zone; the levels of bioaccumulated contaminants in tissues would not be significant due to the short period of time the prey species would be feeding in the area; and marbled murrelets, killer whales, or humpback whales would be unlikely to consume one of the few salmonids or other fish that may pass through the mixing zone. Therefore, potential indirect effects from consumption of contaminated prey would be insignificant.

6.2 Effects Determinations

Table 6-1 presents the effects determinations based on the effects analysis for listed species with potential to occur in the Action Area.

Table 6-1. Effects Determination for Listed Species in the Action Area

Evolutionarily Significant Unit or Distinct Population Segment <i>Scientific Name</i>	Effect Determination
Puget Sound Chinook Salmon ESU <i>Oncorhynchus tshawytscha</i>	May affect, not likely to adversely affect
Puget Sound Steelhead DPS <i>O. mykiss</i>	May affect, not likely to adversely affect

Evolutionarily Significant Unit or Distinct Population Segment <i>Scientific Name</i>	Effect Determination
Coastal-Puget Sound Bull Trout DPS <i>Salvelinus confluentus</i>	May affect, not likely to adversely affect
Puget Sound/Georgia Basin Bocaccio Rockfish DPS <i>Sebastes paucispinis</i>	May affect, not likely to adversely affect
Puget Sound/Georgia Basin Yelloweye Rockfish DPS <i>Sebastes ruberrimus</i>	May affect, not likely to adversely affect
Southern DPS of N. American Green Sturgeon <i>Acipenser medirostris</i>	May affect, not likely to adversely affect
Southern DPS of Pacific Eulachon <i>Thaleichthys pacificus</i>	May affect, not likely to adversely affect
Marbled Murrelet <i>Brachyramphus marmoratus</i>	May affect, not likely to adversely affect
Southern Resident DPS of Killer Whale <i>Orcinus orca</i>	May affect, not likely to adversely affect
North Pacific Humpback Whale <i>Megaptera novaeangliae</i>	May affect, not likely to adversely affect

As described in Section 5.2, the conservation value of PCEs in the action area will not be degraded as a result of the project. Therefore, effects of the proposed action on PCEs of critical habitat for Chinook salmon, bull trout, juvenile bocaccio and yelloweye rockfish, and killer whales are considered not adverse.

Section 7

Essential Fish Habitat Assessment

Federal agencies are required to comply with the Magnuson-Stevens Fishery Conservation and Management Act, as amended in October 1996, by consulting with NMFS on any proposed action that may adversely affect essential fish habitat (EFH). The objective of this EFH assessment is to determine whether or not the proposed action “may adversely affect” designated EFH for relevant commercial, federally managed fisheries species within the proposed Action Area. It also describes the conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects on designated EFH from the proposed action. EFH has been designated in the project Action Area for Pacific Coast Salmon, Pacific Groundfish, and Coastal Pelagics.

EFH is defined as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity” [16 U.S.C 1802(10)]. For the purpose of interpreting this definition of EFH, “waters include aquatic areas (marine waters, intertidal habitats, and freshwater streams) and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and spawning, breeding, feeding, or growth to maturity covers a species’ full life cycle” (50 CFR 600.10).

7.1 EFH Effects Analysis

The EFH implementing regulations, 50 CFR § 600.810(a), define the term “adverse effect” as: any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

As described in Section 1.1, the WWTP discharges disinfected secondary effluent to Crescent Harbor via an existing outfall 3,284 feet from shore. The end of the outfall pipe is at a depth of 41 feet below MLLW. The proposed slipline repair to the outfall would not change the location and there would be no alteration of substrate, slope, aquatic vegetation, or other habitat features.

Effects on water quality from construction of the outfall repairs would be avoided or minimized with the implementation of the measures presented in Section 1.5. These include physical measures to address potential turbidity and erosion and prevent hazardous materials from being released during construction.

Based on the analysis presented in Section 5 and summarized in Section 6.1, the effluent discharge would meet water quality criteria at the boundaries of the mixing zone. Within the mixing zone (which encompasses a radius of 241 feet from the diffusers, equal to approximately 182,374 square

feet, or 4.2 acres of marine habitat), there is potential for adverse effects on species from constituents in the discharge. (In the short term, until the outfall pipe is repaired, a secondary mixing zone of approximately 3.3 acres would also have the potential for adverse effects on listed species.) However, direct effects are considered insignificant due to the relatively small size of the mixing zone, the short period of exposure, and the relatively low levels of pollutants discharged.

Exposure of benthic organisms to contaminants would not be likely because the effluent discharge is buoyant and would rise and disperse in the water column. Therefore, the potential for exposure to contaminated benthic prey is considered insignificant. Forage fish, including surf smelt and sand lance, would be expected to spend a very limited amount of time within the mixing zone of the effluent discharge. Therefore, forage fish would not be adversely affected so as to reduce forage for Chinook salmon and other species. In addition, given the low level of exposure and concentrations of contaminants, bioaccumulation of contaminants in tissues of aquatic organisms would not be expected to any significant degree such as to adversely affect species that prey on them.

The proposed action would not impede migration of listed species due to physical barriers, temperature or other water quality parameters, or presence of toxic contaminants. Based on the analysis in the BA, effects of the proposed action on PCEs of critical habitat for Chinook salmon and other listed species are considered insignificant.

Groundwater monitoring around the WWTP lagoons would be continued to assess potential adverse effects from constituents (e.g., ammonia) leaking into the Crescent Harbor Salt Marsh. If groundwater monitoring results indicate there is potential for adverse effects on juvenile Chinook salmon rearing in the salt marsh from ammonia due to lagoon leakage, consultation with NMFS would be reinitiated.

7.2 EFH Effects Determination

Based on the analysis described in this BA, effects on Pacific coast salmon, Pacific groundfish, and coastal pelagic EFH are limited to the water and substrate immediately around the diffuser within the approximately 4.2 acre mixing zone. (In the short term, until the outfall pipe is repaired, a secondary mixing zone of approximately 3.3 acres would also have the potential for effects on EFH.) In addition, there may be adverse effects on salmonids if ammonia is being released to the Crescent Harbor Salt Marsh and resulting in toxicity.

Given that the area represented by the outfall mixing zone and the salt marsh habitat immediately adjacent to the WWTP is a small fraction of the area of EFH in the action area and Puget Sound, potential effects would have no overall effect on the Pacific coast salmon, Pacific groundfish, and coastal pelagic EFH. The determination of effect on EFH is no adverse effect.

Section 8

Compliance with Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (MMPA) prohibits, with certain exceptions, the take of marine mammals in United States waters and by United States citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. USFWS and NMFS administer the MMPA with a division of responsibilities existing between the agencies. The MMPA prohibits “take” of marine mammals, defined as “to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal” (50 CFR 216.3). The Navy would be required to obtain an incidental take authorization (permit) if the proposed action would result in harassment or other forms of take.

In addition to the listed species discussed in the previous sections, other marine mammals, including gray whale (*Eschrichtius robustus*), Eastern Steller sea lion (*Eumetopias jubata*), Pacific harbor porpoise (*Phocoena phocoena*), and other pinnipeds (seals and sea lions) may use the project Action Area for foraging. Seals and sea lions may use beaches and rocks as haulout sites. Harbor seals are known to haulout onto the off-shore rocks near the ends of Crescent Harbor (Navy 2015).

Gray whales occasionally occur in Puget Sound and forage for ghost shrimp and tube worms in shallow soft bottomed bays. They have been documented in Crescent Harbor (Orca Network 2017) and would be adversely affected if their prey is exposed to contaminants being released to the Harbor via the WWTP outfall.

As described in Section 4.2.1, sediments in the Action Area have been characterized as unimpacted by contaminants with a healthy benthic index based on sediment sampling conducted in 2007 (Ecology 2007a) after 47 years of WWTP operation and discharge to Crescent Harbor. Other than the restoration work at the Crescent Harbor Salt Marsh, there has been no other development or change within Crescent Harbor that could be reasonably expected to have affected sediment quality since the testing was conducted.

Exposure of benthic organisms to contaminants would not be likely because the effluent discharge is buoyant and would rise and disperse in the water column. In addition, the volume of effluent under the proposed action will be significantly less than under the existing conditions. Therefore, the potential for exposure to contaminated benthic prey is considered insignificant. Furthermore, the Action Area represents a very small part of the foraging habitat for top predator species including marine mammals. It is unlikely that a marine mammal would spend a significant portion of its time within the Action Area or consume a significant portion of its prey from the Action Area. Therefore, potential indirect effects from consumption of contaminated prey by marine mammals would be insignificant.

Harassment or other disturbance to marine mammals during construction of the outfall repair would be avoided or minimized by monitoring an established safety zone around the outfall construction area to ensure that no marine mammals are present within the safety zone during construction activities, as described in Section 1.5.3.

The proposed action would not introduce passage barriers, induce growth or development, or result in increased activities in Crescent Harbor that would result in take of marine mammals. Therefore, effects on marine mammals from the proposed action are considered insignificant.

Section 9

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Appendix A

Draft NPDES Permit Conditions

Appendix B

Species Lists

Appendix C

Species Life History Information